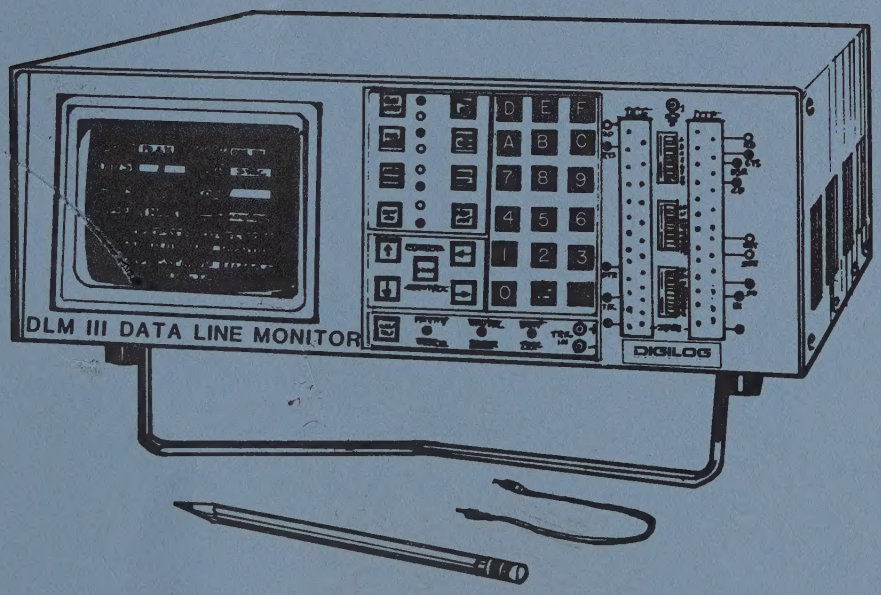
OPERATOR'S INSTRUCTION MANUAL

DLM III DATA LINE MONITOR



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OPERATOR'S MANUAL
DLM III
DATA LINE MONITOR

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DLM III OPERATOR'S MANUAL

PREFACE TO THIRD EDITION

This edition of DLM III's Operator's Manual provides the information necessary to operate DIGILOG's DLM III data line monitor. It is intended to be used along with the Operator's Manual provided with DIGILOG's MSU III mass storage unit, as well as with the manuals that are supplied with other equipment used in the communication system. The system's manuals should be referred to before setting up the parameters necessary, such as protocol structure and bits per character, for operating DLM III in any communication system.

Chapter 1 of this manual contains a general description of DLM III along with a listing of its characteristics and specifications.

Chapter 2 contains descriptions of the unit's controls, switches, indicators, and connectors.

Chapter 3 provides the information necessary to connect and operate the unit in a communications network.

Chapter 4 describes how DLM III is used in various test configurations, both passive and active.

Appendix 1 contains charts of codes used in the DLM III.

A Customer service card is provided as the manual's last page. If it is necessary to return a DLM III to DIGILOG for repair, follow the instructions at the top of the service card to ensure that the unit receives prompt attention.

Every attempt has been made to include the latest and most accurate information in this manual's third edition. Users are requested to submit any suggestions or corrections that they believe should be included in the manual's next edition. Suggestions for changes should be directed to:

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CUSTOMER SERVICE CARD

Tear-off service card with brief explanation of use.

This card must be filled out by the customer prior to returning equipment to DIGILOG's customer service department for repair.

CHAPTER 1

DESCRIPTION OF EQUIPMENT

1-1. INTRODUCTION

This chapter contains a general description of DLM III along with a listing of its characteristics and specifications.

1-2. GENERAL DESCRIPTION

DIGILOG's DLM III is a compact, low cost data line monitor that can be effectively used by relatively unskilled personnel to isolate most faults that occur in a communication system. DLM III can perform a number of complex diagnostic tests, including a self-test, because it operates under control of a microprocessor.

The microprocessor's operating system directs all functions performed by DLM III. The control program uses menus shown on the unit's video display for prompting the entry of the parameters required for initially setting up DLM III. After the parameters are entered, depressing a RUN key causes DLM III to perform all functions under control of the microprocessor and according to the menu's final contents. DLM III's video display can then be used to view the capture buffer's contents or to see the results of any diagnostic test that was run.

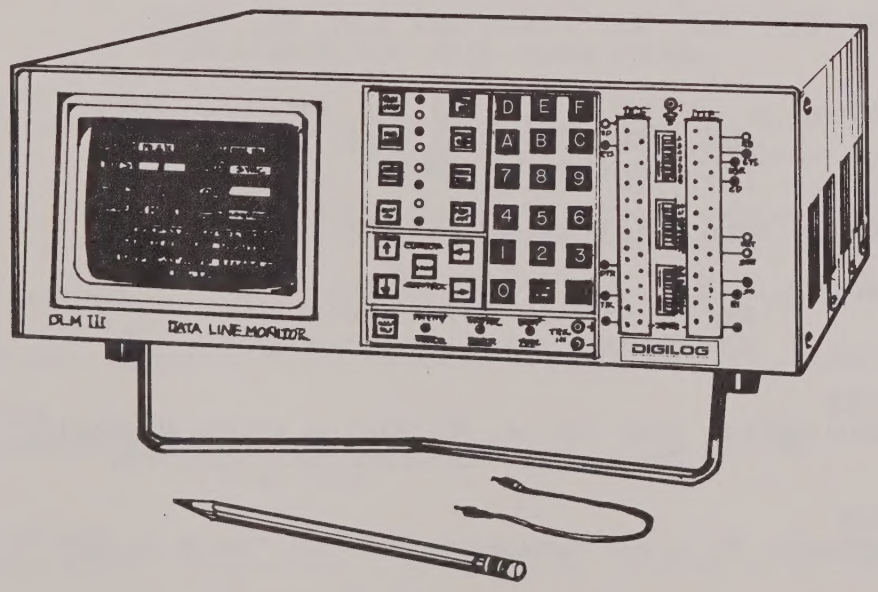


FIGURE 1-1. DIGILOG DLM III DATA LINE MONITOR

The type of diagnostic tests available depend upon DLM III's configuration. The basic equipment functions as a monitor, and it enables the operator to selectively view on the video display the exchange of characters among equipment in the communication system.

Optional circuitry enables DLM III to both transmit and respond to protocol messages, and to perform a bit error-rate test (BERT). This capability permits operators to exercise terminal equipment at its basic level. In a large system, where equipment is located at remote sites, this interactive capability allows operators to configure DLM III to emulate either the data terminal equipment (DTE) or the data communication equipment (DCE). Therefore, one operator using DLM III can locate and identify nearly any fault that may occur in most communication systems.

1-3. SPECIFICATIONS AND CHARACTERISTICS

Table 1-1 contains a listing of DLM III's specifications and characteristics. The table includes information for both the passive (monitor only) and active units (monitor with output capability).

TABLE 1-1. DLM III SPECIFICATIONS AND CHARACTERISTICS

CODES:	ASCII, EBCDIC or hexadecimal; standard. Two customer specified codes; optional.
TIMING:	Synchronous, asynchronous, or isochronous.
PROTOCOLS:	BSC, SDLC direct, SDLC NRZI, HDLC, BDLC, DDCMP, ADCCP, X.25, and IPARS/SABRE.
SPEEDS:	50, 75, 110, 134.5, 150, 300, 600, 1050, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 19200, EXTERNAL, or OTHER.
PARITY:	None, odd, even, all 1s, or all 0s.
FRAMING:	5, 6, 7, 8, 9, or bit stream. Asynchronous; 1, 1.5, or 2 stop bits. Synchronous; none, 1, or 2 sync bytes.
BLOCK ERROR CHECKS:	None, CRC/16, FCS SDLC, or LRC/8; standard. One customer specified check; optional.
TRAP SEQUENCE:	Up to six characters, including "don't cares."

(Continued)

TABLE 1-1. DLM III SPECIFICATIONS AND CHARACTERISTICS
(Continued)

VIDEO DISPLAY: Up to 512 characters; 16 lines composed of 32 characters each.

DISPLAY ATTRIBUTES: Four available in various combinations; blink, underline, reverse video, and half intensity.

MEMORY CAPACITY: Approximately 8000 data characters stored in internal capture buffer. An additional 8000 attribute characters. can also be stored.

INTERFACE: RS-232-C and CCITT V.24; standard.

INTERFACE BREAKOUT PANEL: Twenty-four interface signals are available at the front panel for monitoring and patching. Pin 1 (frame ground) available for monitoring.

OUTPUT SIGNALS: Composite video output to an external monitor.
TTL-compatible event marker output to external equipment.
Output to an external mass storage device.
Output to a printer for generating hard copy of either the video display's data or the capture buffer's contents.

OUTPUT MESSAGES: FOX message, with user defined header and trailer.
Buffer memory contents consisting of 128 characters that can be segmented into 64 individual messages.
A bit error-rate test (BERT) message consisting of a 511-bit per block, pseudorandom sequence pattern.

DIMENSIONS: Height, 5-3/16"; width, 15-1/4"; depth, 16."

WEIGHT: Seventeen pounds including carrying cover with handle.

POWER CONSUMPTION: Sixty-five Watts maximum at 115 VAC, 60 Hz; 220V, 50Hz.

OPERATING ENVIRONMENT: Temperature; 0 to 50 degrees Celsius, 32 to 120 degrees Farenheit.
Humidity; up to 90%, noncondensing.

(End)

CHAPTER 2

CONTROLS, INDICATORS, AND CONNECTORS

2-1. INTRODUCTION

This chapter describes how to configure DLM III's voltage select switches, how to check the unit's fuse, and how to interpret the results of the unit's self-test. Included are descriptions of the unit's controls, indicators, and connectors.

2-2. OPERATING VOLTAGE

DLM III is normally shipped from the factory ready to operate using a primary source voltage of 115 VAC, 60 Hz; however, it is designed to operate at either 115 or 220 VAC, and the source can be either 50 to 60 Hz. Perform the following procedure to check or change the unit's operating voltage configuration. Use Figure 2-1 to locate the switches referred to in the procedure.

1. Check that DLM III's line cord is not plugged into an outlet.

2. Check the setting of the rear panel voltage select slide switch. The number seen, either 115 or 220, must be in the range of the voltage applied to DLM III.

3. Check the rating of the fuse in the fuseholder. If the unit is configured to operate at 115 VAC, 50 or 60 Hz, the fuseholder must contain a 1.5 A slow-blow fuse. If it is configured to operate at 220 VAC, 50 or 60 Hz, the fuseholder must contain a 0.75 A slow-blow fuse; refer to step 6 for fuse replacement procedure.

4. Check the setting of the voltage frequency select plug located on the central processing board (bottom board when looking into the unit from above). The plug is set for 60 Hz from the factory when delivered to a customer site located in North America. The plug, however, must be positioned to the setting which corresponds to the frequency of the voltage applied to DLM III. If the unit is being configured to operate using 50 Hz then pull up the plug until it disengages; rotate it to the 50 Hz position and re-install it. See Figure 2-2 for the location of the plug.

5. Change the voltage select switch setting by moving the slide to one extreme position or the other. If DLM III is being configured to operate from 220 VAC, move the slide until it stops and the number 220 is showing.

(Continued)

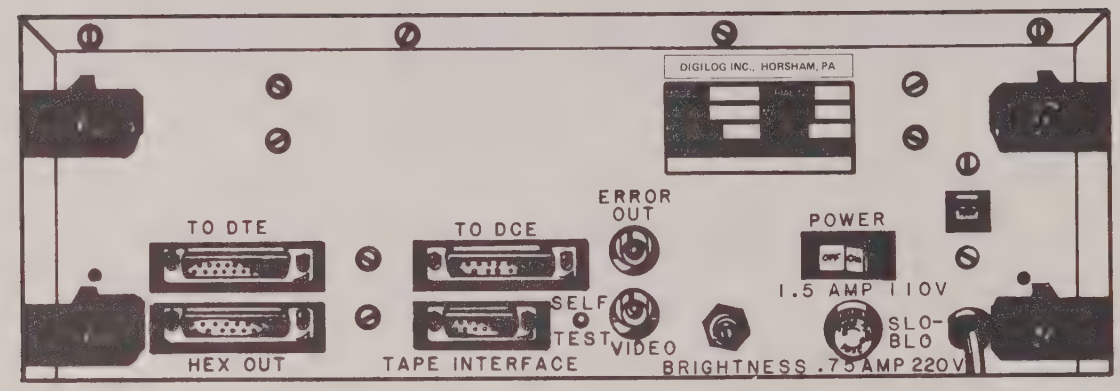


FIGURE 2-1. REAR PANEL CONTROLS AND CONNECTORS

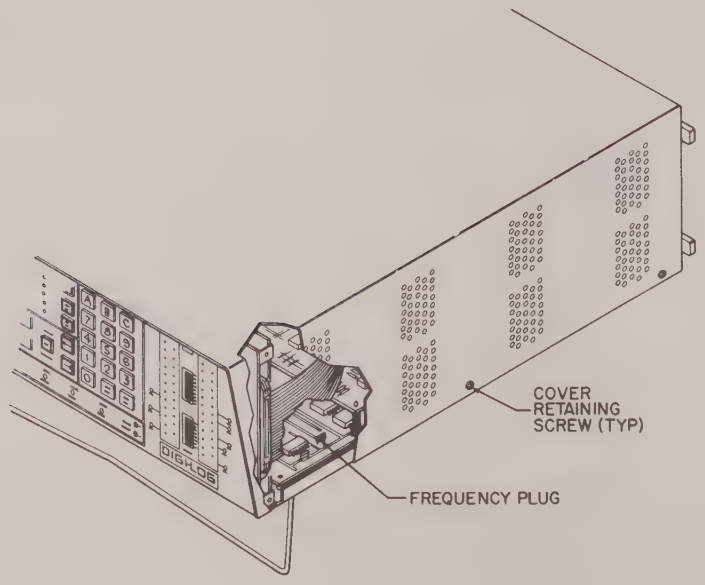


FIGURE 2-2. INTERNAL BOARD; LOCATION OF THE VOLTAGE FREQUENCY SELECT PLUG

6. Turn the unit off. Change the fuse by turning the fuseholder cap until the cap is free, and pull the cap and fuse out of the fuseholder. If a new fuse is being installed note the setting of the voltage select switch, and install either a 1.5 A slow-blow fuse if the switch is set to 115 V, or a 0.75 A slow-blow fuse if the switch is set to 220 V.

2-3. APPLYING POWER

Before plugging the line cord into an outlet, refer to paragraph 2-2 and verify that DLM III is configured to operate using the voltage supplied by the outlet. Check that the unit's rear panel POWER switch is set to OFF before plugging the line cord into the outlet.

Apply power to DLM III by setting the POWER switch to ON. DLM III automatically performs both a lamp test of its light-emitting diode (LED) indicators (except for those mounted on the EIA breakout panel) and an internal diagnostic self-test each time that the unit is turned on.

Immediately after the POWER switch is set to ON, verify that DLM III's front panel indicators light. A LED failure may cause an incorrect indication during system testing, but it does not mean that the unit cannot be used; however, it does mean that the indicator should be repaired as soon as possible.

Upon completion of the internal self-test, one of two messages appears on the video display. If DLM III is functioning properly, the following message (with blinking prompt) is seen:

PASSED X DIAGNOSTICS (X = current software revision)
DEPRESS "MENU SEL" TO CONTINUE (blinking prompt)

If DLM fails the self-test, the following message is seen:

RAM ERROR
DEPRESS "MENU SEL" TO CONTINUE (blinking prompt)

A RAM failure does not mean that the unit cannot be used; however, a RAM error may cause an incorrect indication during system testing. If the RAM error message is displayed, have DLM III repaired as soon as possible to avoid problems during system testing.

2-4. FRONT PANEL CONTROLS, INDICATORS, AND CONNECTORS

DLM III's front panel controls, indicators, and connectors are separated into six functional groups; see Figure 2-3:

1. Video display unit.
2. Control keys and associated indicators.
3. Cursor control keys.
4. Numeric keypad (hexadecimal notation).
5. Error reset key and indicators, and trigger (+) and (-) connectors.
6. Interface breakout and monitor panel.

The following paragraphs contain functional descriptions of each group's controls, indicators, and/or connectors.

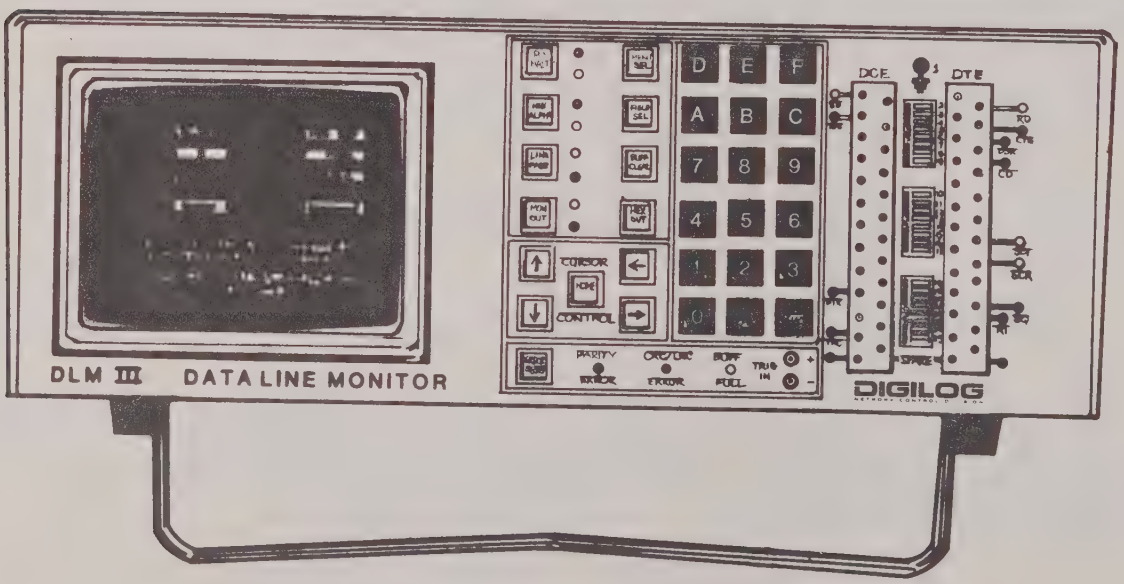


FIGURE 2-3. FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS

2-4-1. VIDEO DISPLAY UNIT

The video display unit contains a 5-inch cathode-ray tube (CRT) that uses P4 phosphor. The CRT is covered by a tinted faceplate to reduce glare and improve contrast of the displayed image. The video display's BRIGHTNESS control is located on the unit's rear panel; see Figure 2-1.

The video display is used by DLM III to communicate with the operator. Messages containing prompts appear on the video display and assist the operator in setting up the unit's operating parameters. The video display is also used by the operator to view the capture buffer's contents.

Four video display attributes are used in various combinations:

1. Underline; all receive data characters are underlined when displayed.

2. Blink; characters with incorrect parity and those with framing errors, as well as CRC, FCS, LRC, and trap characters, blink when displayed.

3. Reverse Video; selectable characters concurrent with signals RTS, CD, or signals patched to TRIG (+) and (-) connectors are displayed reverse video.

4. Half Intensity; characters not in sync during synchronous operation are displayed half intensity.

When DLM III is operated in the run state and monitoring data on-line, up to 448 data characters are displayed. In this case, the displayed data are shown on the first 14 lines of the display, and each line is made up of 32 data characters. The last two lines of the 16 line display are reserved for status information such as baud rate, bits per character, and code.

When the unit is operated in the halt state, all 16 display lines are available and up to 512 data characters are shown on the video display.

2-4-2. FRONT PANEL CONTROL KEYS AND INDICATORS

Eight control keys are used to set up and operate DLM III. Five keys are used to place the unit in an operating state, and the remaining three keys are used to control the unit while it is operating in the selected state. Four of the five state-select keys have LED indicators adjacent to their legends, the indicators light to identify the setting of the associated key. Figure 2-3 shows the location of the inscribed keys and indicators, and Table 2-1 contains a listing of the keys along with a brief description of each key's function.

TABLE 2-1. FRONT PANEL CONTROL KEYS AND INDICATORS

KEY LEGEND	INITIAL STATE	FUNCTIONAL DESCRIPTION
RUN HALT	HALT	HALT is DLM III's operating state after initialization or reset. This is also the state used for setting up the unit, viewing the capture buffer's contents, and for playing back data from MSU III. RUN is DLM III's on-line operating state. It is the state used for loading the capture buffer during passive operations and for sending messages during active operations. RUN/HALT is an alternate action key. DLM III's operating state is indicated by the LED next to the key's legend that is turned on.
HEX ALPHA	ALPHA	ALPHA is the operating state used to view data in its alphanumeric form. Except for the menu TIMER and OTHER fields, data affected include contents of the unprotected variable fields, as well as the capture buffer's contents. HEX is the operating state used to view data in its two-character, hexadecimal form. Data affected are the same as for the ALPHA state. HEX/ALPHA is an alternate action key. DLM III's operating state is indicated by the LED next to the key's legend that is turned on.
LINE PAGE	LINE	This key determines how the contents of the capture buffer are shown on the video display. LINE is the operating state used to scroll capture buffer data shown on the video display one line at a time each time a cursor control key is depressed. PAGE is the operating state used to scroll capture buffer data shown on the video display one page, or 16 lines, each time a cursor control key is depressed. LINE/PAGE is an alternate action key. DLM III's operating state is indicated by the LED next to the key's legend that is turned on.

(Continued)

TABLE 2-1. FRONT PANEL CONTROL KEYS AND INDICATORS
(Continued)

KEY LEGEND	INITIAL STATE	FUNCTIONAL DESCRIPTION
MON OUT	MON	MON is DLM III's passive, or monitor only, operating state; it is the state used for loading data into the capture buffer. OUT is the unit's active state; monitor and output. Units with output capabilities use this state to monitor and transmit messages. MON/OUT is an alternate action key; DLM III's operating state is shown by the LED next to the key's legend that is turned on.
MENU SEL	Active	MENU SEL (menu select) is used to call a menu when DLM III is in the halt state. The key is also used to cycle through both the pages and capture buffer. MENU SEL is a momentary action key and does not have LEDs next to its legends.
FIELD SEL	Active	FIELD SEL (field select) is used to advance, or roll, the contents of each menu page's variable fields during set up of DLM III. This key is also used to delimit messages in DLM III's output buffer. FIELD SEL is a momentary action key and doesn't have LEDs next to its legends.
MSU READ	Active	MSU READ (mass storage unit read) is used to select data from MSU III when that unit is used. Depressing key MSU READ causes the screen to clear and an MSU READ message to be displayed. MSU READ is a momentary action key, and doesn't have LEDs next to its legends.
HEX OUT	Active	HEX OUT (hexadecimal output) is used to deliver data from DLM III to a printer, or other serial ASCII device. Depressing this key causes a special, menu page to be displayed. The operator then sets up certain parameters before data are sent to the device. HEX OUT is a momentary action key, and doesn't have LEDs next to its legends.

2-4-2-1. RUN HALT Key

DLM III initializes in the halt state with the lower LED next to the RUN HALT key turned on; refer to Table 2-1. Depressing this key the first time causes DLM III to enter the run state, and it either monitors the line (passive operation) or transmits data (active operation) according to the menu parameters selected.

In the run state, the upper LED next to the key lights and the lower LED turns off. Depressing the key a second time places DLM III in the halt state, stops loading of the capture buffer, stops output operations, and lights the lower LED next to the key.

When DLM III is in the run state, the only other active control keys are HEX ALPHA, DON'T CARE, and ERROR RESET. In the run state, key ERROR RESET turns off the BUFF FULL, CRC/LRC ERROR, and PARITY ERROR indicators.

2-4-2-2. HEX ALPHA Key

DLM III initializes in the ALPHA (alphanumeric) state with the lower LED next to the key turned on; refer to Table 2-1. In this operating state the video display's contents are shown as alphanumeric characters according to the ASCII format. Depressing key HEX ALPHA the first time causes the displayed data, except for protected fields in the menu's pages, to appear as 2-character, hexadecimal codes.

2-4-2-3. LINE PAGE Key

The LINE PAGE key determines how the capture buffer's contents are shown on the video display when DLM III is placed in the halt state. The setting of this key is indicated by the LEDs next to the key.

DLM III initializes in the LINE state; refer to Table 2-1. This key is used along with cursor control UP and DOWN keys to scroll data vertically over the video display. When the cursor is positioned at the top of the screen and cursor control key UP is depressed, data scrolls off the bottom of the screen one display line at a time. At the same time, new data moves onto the video display at the top of the screen.

When the cursor is positioned at the bottom of the screen and the cursor DOWN key is depressed, data moves off the top of the screen one line at a time and new data appear on the screen's bottom line.

In the PAGE state, data are scrolled over the video display on a page-by-page basis. All 16 display lines are replaced on the video display each time the cursor control keys are depressed, and the direction of movement is the same as described for the LINE state.

2-4-2-4. MON OUT Key

The MON OUT key is used to select either the passive (MON) or active (OUT) operating states; refer to Table 2-1. DLM III initializes in the passive state and loads data into the capture buffer after the operating parameters are entered and key RUN is depressed.

To select the active operating state, depress key MON OUT once; the LED next to MON turns off, and the LED next to OUT lights. The active operating state enables transmitting messages that are loaded into DLM III during setup operations. Both monitor and output operations can be performed while the unit is in the active state.

The setting of key MON OUT also determines which menu pages can be displayed. When the key is set to MON, only the two menu pages associated with passive operations are displayed. Setting the key to OUT allows display of the menu's output page.

The output page appears as menu page three if the unit is equipped with this operation. If the unit is not equipped for active operation and MON OUT is depressed, the following message is displayed:

"NOT EQUIPPED"

2-4-2-5. MENU SEL Key

Key MENU SEL (menu select) is used to call the menu to the screen; refer to Table 2-1. This key is only active when DLM III is halted (key RUN HALT set to HALT). The first time MENU SEL is depressed, menu page one appears on the screen, and each following keystroke causes a new page to appear.

When DLM III is connected into a communication system, key MENU SEL is used to call the menu for entering the setup parameters after the unit's self-tests are completed. Later, the menu's contents can be reviewed, and possibly changed, by placing DLM III in the halt state and then depressing the MENU SEL key.

2-4-2-6. FIELD SEL Key

Key FIELD SEL (field select) is used to set up and/or enter parameters in the menu pages' variable fields, and to delimit messages entered in the output buffer's unprotected variable field. This key is used when DLM III is halted and after key MENU SEL is depressed; refer to Table 2-1.

Protected fields are shown full intensity on the video display, and they are not user programmable. Unprotected fields are shown half intensity on the video display and are user programmable. Data are entered into the unprotected fields using the hexadecimal keypad's keys.

Depressing key FIELD SEL causes the contents of the menu's variable field at the cursor position to show the next choice available in that field. When the field's last choice is shown, depressing this key causes the field's first choice to be displayed again. In effect, the key "rolls" the variable field's contents one position each time it is depressed.

2-4-2-7. MSU READ Key

Key MSU READ (mass storage unit read) is used to select data from the mass storage unit (MSU III) when this device is connected to DLM III, rather than from only the capture buffer. Since data from MSU III is first loaded into the capture buffer, the only change in DLM III's operating characteristics is the increase in storage capacity (over 400,000 bytes) caused by MSU III being connected to DLM III's capture buffer.

MSU READ key is active only during the halt state.

Depressing the active MSU READ key clears the screen, and a MSU READ message appears on both sides of the screen, just above the status message line.

A second depression of the active MSU READ key returns DLM III to normal operation; that is, data is read from only the unit's capture buffer.

2-4-2-8. HEX OUT Key

The HEX OUT key is used to set up DLM III for sending data to an external printer or other serial ASCII compatible device. Key HEX OUT is active when DLM III is halted; refer to Table 2-1.

Depressing key HEX OUT causes a special one-page menu to be shown on the video display (Figure 3-9). The initial parameters can be altered, and DLM III then functions according to the menu's final state. A prompt shown at the bottom of the screen tells the operator how to begin and end print operations.

2-4-2-9. Cursor Control Keys

The cursor control keys consist of four keys labeled with arrows, and a fifth key labeled HOME; see Figure 2-3. These keys are used to move the blinking block cursor from place to place on the video display's screen. These five keys are active when DLM III is in the halt state.

The keys move the cursor in the direction designated by each key's legend. Each key depression causes the cursor to move one charcter position, except for the HOME key. The HOME key moves the cursor to the first available character position at the upper left corner of the screen. Holding any one of the other four keys down for approximately a second causes the cursor to move in the direction of the key's inscribed arrow for as long as the key is held down.

VIEWING DATA

The cursor control keys are active when DLM III is halted and there are data in the capture buffer. Depressing the UP key with the cursor located at the top of the video display screen causes data to scroll off of the bottom of the screen. Depressing the DOWN key with the cursor at the bottom of the screen causes data to move off the top of the screen.

How data scrolls off the screen depends upon the setting of key LINE PAGE. If the key is set to LINE, then data move off of, and onto, the screen on a line-by-line basis. If the key is set to PAGE, then data move over the screen on a page-by-page basis; that is, either 512 or 256 characters are moved at a time depending on the selection shown in menu page one's "display" field.

Depressing the cursor DOWN key moves data over the screen toward the end of the capture buffer, and scrolling stops when the end of the buffer is reached. The cursor UP key moves data over the screen toward the beginning of the buffer. Depressing the cursor HOME key automatically displays data starting at the beginning of the buffer, and the cursor moves to the "home" position on top of the buffer's first character position.

Cursor control keys LEFT and RIGHT move the cursor along the cursor line, and these keys can be used to position the cursor over any character shown on the screen.

If key LEFT is held down for a period longer than approximately a second, the cursor will automatically move off of the beginning of the cursor line and index to the end of the next upper line. If the key is depressed long enough, the cursor will reach the "home" position and stop moving.

Holding down key RIGHT causes the cursor to move over the screen on a character-by-character basis. In this case, the cursor indexes down the screen and stops at the last character position in the screen's lower right-hand corner.

MENU SELECTION

Cursor up or down commands entered while the cursor is located within a menu field will move the cursor to the next upper or lower field.

Cursor left and right commands can be used to move the cursor within as well as among menu fields. A cursor left command given while the cursor is at the first character position of a field causes the cursor to move to the preceeding field. A cursor right command given while the cursor is at the last position of a field causes the cursor to move the first position of the next field.

If the cursor is located within an unprotected variable field (these fields are shown half intensity on the video display), the cursor moves one character position left or right for each depression of a cursor LEFT or RIGHT key.

2-4-3. KEYPAD

The keypad contains 18 keys; key 0 through F, DON'T CARE, and CLEAR; see Figure 2-3. Keys 0 (zero) through F produce hexadecimal codes and are only active when DLM III is halted and in the menu select state. The 16 hexadecimal keys are used to enter data in the menu's unprotected variable fields. Key DON'T CARE is used to enter characters having no hexadecimal value. Key CLEAR is used to erase characters.

The following paragraphs contain information for using these 18 keys.

2-4-3-1. Hexadecimal Keys

Up to two entries (keystrokes) can be made when using the hexadecimal keys to enter character data into the menu's unprotected variable fields. The first keystroke enters a character code corresponding to the key depressed, and that character appears under the cursor. It is a complete character, but it is made up of the four least significant bits (LSBs) of the 8-bit code used by DLM III. That is, the 8-bit code's four most significant bits (MSBs) are still 0s.

After the initial keystroke, four courses of action are possible:

1. Enter a second hexadecimal digit at the cursor's position using keys 0 through F.

2. Depress one of the cursor control keys, and move the cursor to another character position.

3. Depress the DON'T CARE key.

4. Depress the CLEAR Key.

Entering a second digit causes the original four LSBs to become the four MSBs of the 8-bit code. The four LSBs change to the value of the second keystroke's digit. After the second keystroke, the character shown is the result of the eight bits entered by both keystrokes . The cursor automatically moves to the next position after the second keystroke.

Depressing one of the cursor control keys causes the cursor to move to either a new character position within the unprotected variable field, or to a new variable field. The character entered by the first keystroke remains in the field at the cursor's original position.

2-4-3-2. DON'T CARE Key (multifunctional)

Depressing the DON'T CARE key erases the character entered by the first keystroke. At the same time, a "don't care" character having no hexadecimal value is entered, and the cursor automatically moves to the next position. Refer to paragraph 3-4-1 for further information regarding the use of "don't care" characters.

2-4-3-3. CLEAR Key

Depressing the CLEAR key erases all characters in the unprotected variable field from the cursor position to the end of the field, including the character at the cursor position. The cursor, however, remains at the original position and new character data can be entered in the field.

2-4-4. ERROR RESET KEY, INDICATORS, AND TRIGGER CONNECTORS

This functional group consists of a key that resets two error indicators, as well as the two error indicators, a buffer full indicator, and two trigger connectors; see Figure 2-3. The components of this group are described in the following paragraphs.

2-4-4-1. ERROR RESET Key

The ERROR RESET key is used to turn off indicators PARITY, CRC/LRC ERROR, and BUFF FULL. This key only clears these indicators after they light to show that DLM III's circuits have detected a character or block check failure, or to indicate that the capture buffer is full.

2-4-4-2. PARITY ERROR Indicator

The PARITY ERROR indicator lights if one or more individual characters fail a parity test. The parity test performed, however, depends upon the selection entered in menu page two's PAR field. Characters that fail the selected parity test and cause the indicator to light are shown blinking on the video display. Depressing key ERROR RESET only resets the indicator.

During asynchronous operation, however, the PARITY ERROR indicator does not light if a framing error occurs and the trap feature is not selected. Given these two conditions (framing error and no trap set), characters with framing errors are indicated only as blinking characters on the video display; they do not cause indicator PARITY ERROR to turn on.

2-4-4-3. CRC/LRC Indicator

The CRC/LRC indicator lights if a block check is selected in menu page two's CRC/LRC field, and the block check character(s) calculated by DLM III don't match the character(s) contained in the block of data captured. The failed characters are shown blinking on the video display. Depressing key ERROR RESET only resets the indicator.

2-4-4-4. BUFF FULL Indicator

Indicator BUFF FULL (buffer full) lights when the capture buffer's counter has counted 8k of data characters. The indicator remains on until key ERROR RESET is depressed.

2-4-4-5. Trigger Connectors

The TRIG IN (+) & (-) connectors, or trigger connectors (see Figure 2-3), are used to produce reverse video characters on the video display. Circuits in DLM III detect a positive signal at the TRIG (+) connector and negative signal at the TRIG (-) connector. The signal's transitions are used to initiate and terminate the reverse video attributes. Inputs to the two connectors can be jumpered from any one of the pin jacks on the unit's breakout and monitor panel; refer to paragraph 2-4-5.

2-4-5. INTERFACE BREAKOUT AND MONITOR PANEL

The interface breakout and monitor panel is used for checking and modifying signals at the communications interface. All of the leads at the RS-232-C, CCITT V.24, interface can be accessed through the breakout panel. The panel supports three operations:

1. Patching the interface leads' signals between the DTE and DCE for test purposes using the supplied jumper cables.

2. Switching the available interface leads open or closed for testing purposes.

3. Monitoring the interface leads' status using the LED indicators mounted on the front panel.

2-4-5-1. BREAKOUT PANEL Connectors

The breakout panel contains two strips of 25 test points each, wired directly to the communications interface; one connector is labeled DCE (data communication equipment) and the other is labeled DTE (data terminal equipment); see Figures 2-3 and 2-4. Pins 9 and 10 of these strips, however, are connected to power supplies in DLM III and can be used to force any interface lead to either a positive or negative state. Both power supplies (the +12 VDC supply connected to pin 9, and the -12 VDC supply connected to pin 10) contain circuits that protect them from harm if they are connected to ground.

NOTE

DLM III DOES NOT CONNECT THE EIA INTERFACE FRAME GROUND AT PIN 1 TO ITS OWN INTERNAL FRAME GROUND.

Each connector's signals are accessed by plugging jumper leads into pin jacks. Jumper cables are provided with DLM III and are secured inside the unit's front cover. Interface frame ground (EIA pin 1) is not accessible for patching; however, interface frame ground is available for test purposes at the pin jack located just above the breakout and monitor panel; see Figure 2-4.

2-4-5-2. BREAKOUT PANEL Switches

Three banks of miniature switches (DIP SWITCHES, Figure 2-4) are mounted between the panel's two large connectors. Each of the 24 individual switches is provided with a number corresponding to the interface lead connected to the switch. The switches are used during testing to open and close individual lines between the DTE and DCE. As Figure 2-4 shows, no switch is provided for pin 1.

2-4-5-3. BREAKOUT PANEL Indicators

Fourteen LED indicators are mounted next to the breakout panel's connectors. Twelve indicators are wired directly to specific interface leads as listed in Table 2-2. Legends next to the indicators identify the interface signal monitored by each LED.

The two remaining indicators are not prewired and are labeled SPARE. These indicators can be connected with jumper wires to any of the panel's pin jacks for monitoring the status of the pin jack's signal.

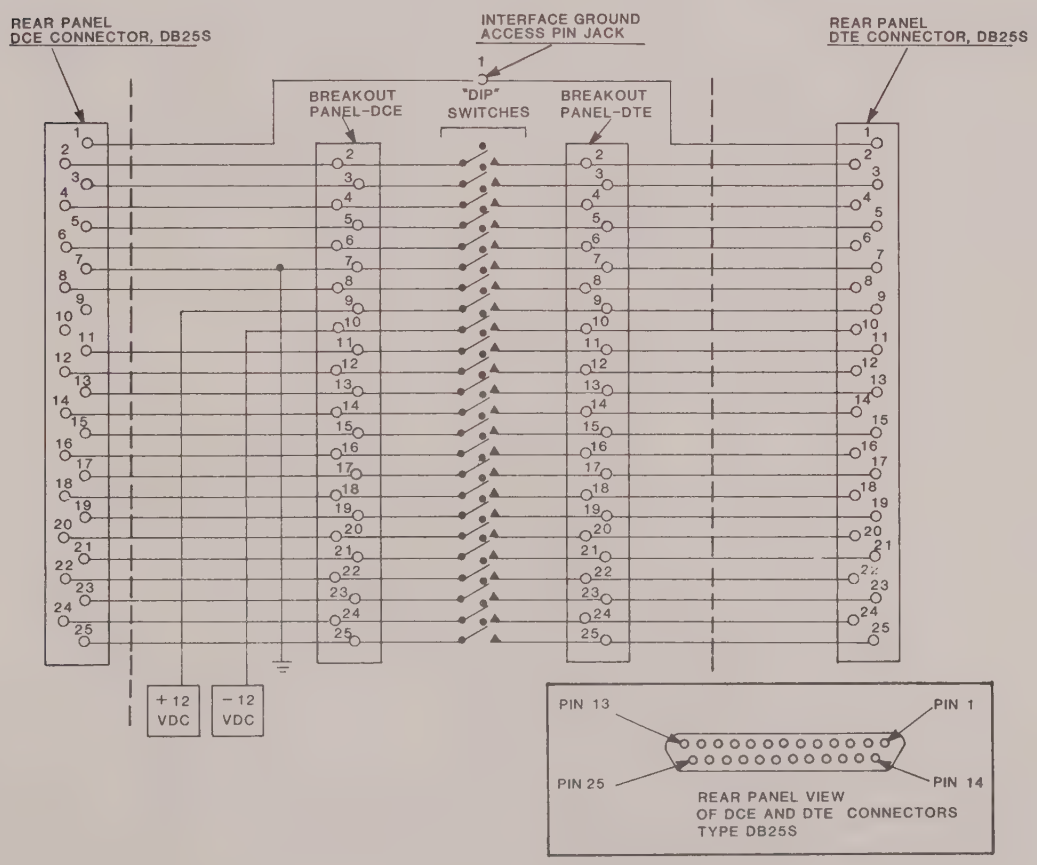


FIGURE 2-4. BREAKOUT AND MONITOR PANEL; FUNCTIONAL SCHEMATIC DIAGRAM

Except for the LEDs connected to interface pins 2 and 3, a minimum of +3 VDC is required to light the indicators and -3 VDC to extinguish them. In the range between (+) and (-) 3 VDC their state is undefined. The LEDs connected to pins 2 and 3 require a minimum of -3 VDC to light and +3 VDC to extinguish, and in the range between (+) and (-) 3 VDC their state is undefined.

TABLE 2-2. BREAKOUT PANEL INDICATORS AND INTERFACE SIGNALS

PIN NO.	SIGNAL
PIN 2	SD
PIN 3	RD
PIN 4	RTS
PIN 5	CTS
PIN 6	DSR
PIN 8	CD

PIN NO.	SIGNAL
PIN 15	SCT
PIN 17	SCR
PIN 20	DTR
PIN 21	SQ
PIN 22	RI
PIN 24	TRC

2-5. REAR PANEL CONNECTORS AND CONTROLS

The rear panel connectors and controls are separated into four functional groups:

1. Monitor (passive) and output (active) connectors that are RS-232-C and CCITT V.24 compatible.
2. MSU III INTERFACE and HEX OUT connectors.
3. VIDEO and ERROR OUT connectors.
4. Operating controls.

The following paragraphs contain functional descriptions of each group's connectors and controls.

2-5-1. MONITOR AND OUTPUT CONNECTORS; RS-232-C AND CCITT V.24 COMPATIBLE

The monitor and output group contains two DB25S connectors; one labeled TO DTE (to terminal equipment), the other TO DCE (to modem); see Figures 2-1 and 2-4. The rear panel connectors are used to connect DLM III into the communication system for passive and active operations. Both 25-pin female connectors are wired according to RS-232-C and CCITT V.24. A further description of the monitor and output connectors' relation to the interface breakout and monitor panel is contained in Chapter 4.

2-5-2. MSU III INTERFACE AND HEX OUT CONNECTORS

This group consists of two connectors: a 15-pin connector (DB15S) labeled MSU III INTERFACE, and a 25-pin connector (DB25S) labeled HEX OUT; see Figure 2-1 and refer to Table 2-3. Connector MSU III INTERFACE is wired to provide a TTL-level output signal to an external device for mass storage. Connector HEX OUT (hexadecimal output) is wired to provide an EIA compatible signal output to any printer, or other device, that uses an ASCII compatible serial interface; such as tape or disk units, and acoustic couplers.

TABLE 2-3. DISK INTERFACE AND HEX OUTPUT CONNECTORS; PIN DESIGNATIONS

MSU III INTERFACE CONNECTOR

PIN NO. (EIA)	SIGNAL (MSU)	FUNCTION
PIN 1	TPD0	Data to/from device
PIN 2	TPD1	Data to/from device
PIN 3	TPD2	Data to/from device
PIN 4	TPD3	Data to/from device
PIN 5	TPD4	Data to/from device
PIN 6	TPD5	Data to/from device
PIN 7	TPD6	Data to/from device

PIN NO. (EIA)	SIGNAL (MSU)	FUNCTION
PIN 8	TPD7	Data to/from device
PIN 9	WRITE CLK	Timing to device
PIN 10	SIGNAL GND	Ground return
PIN 11	READ CLK	Timing to device
PIN 12	SIGNAL GND	Ground return
PIN 13	TPDS	Write strobe to DLM
PIN 14	READ	Read strobe to DLM
PIN 15	MSU READ	DLM reading disk

HEX OUT CONNECTOR

PIN NO. (EIA)	SIGNAL (MSU)	FUNCTION
PIN 3	PTDR	Serial data to device
PIN 6	DSR	Dataset ready
PIN 7	SIGNAL GND	Ground return
OTHER PINS ARE NOT DESIGNATED		

Signals from connector HEX OUT can be sent to any destination, and in any configuration, by routing the signals back through DLM III. The unit's breakout and monitor panel is then used to provide any signals necessary, or to cross-connect the signals already present, to configure the DLM III's output to conform to the receiving equipment's input; see Figure 2-4 and refer to paragraph 2-4-5-1.

The manuals for the device being transmitted to (printer, acoustic coupler, etc.) should be consulted for the configuration of the required signals. Plus and minus 12 VDC levels are available on pins 9 and 10, respectively, of the breakout and monitor panel.

Signals are routed from HEX OUT and through DLM III in the following manner. Place DLM III in the monitor, or passive, operating mode. Connect the output of HEX OUT to connector TO DTE, and then connect the receiving equipment to connector TO DCE.

The procedure described above is recommended for using DLM III to send data to a remote site via a communications link.

2-5-3. VIDEO AND ERROR OUT CONNECTORS

The VIDEO and ERROR OUT connectors are both standard BSC connectors; see Figure 2-1. The VIDEO connector provides a RS-170 compatible, composite video signal. The ERROR OUT connector supplies a positive, TTL-compatible marker pulse (approximately five microseconds duration) when circuits in DLM III detect a parity error, CRC/LRC error, a trap condition is satisfied, or when the error reset key is depressed.

2-5-4. OPERATING CONTROLS

The operating controls group, see Figure 2-1, includes the video display's BRIGHTNESS control, the unit's SELF-TEST and POWER on/off switches, and the voltage select slide-switch. A fuseholder is mounted near the POWER switch.

2-5-4-1. BRIGHTNESS Control

The BRIGHTNESS control is used to vary the video display's intensity, but it can also be used to improve (fine tune) the display's contrast.

2-5-4-2. SELF-TEST Switch

CAUTION

ONLY USE THE SELF-TEST ROUTINE IF A FAULT IS SUSPECTED IN DLM III. WHEN THE SELF-TEST IS PERFORMED, ALL MEMORY LOCATIONS ARE USED, AND ALL THE MENU'S VARIABLE FIELDS ARE RESET. DURING THE SELF-TEST, CAPTURE BUFFER DATA ARE REPLACED WITH TEST DATA.

Switch SELF-TEST is recessed below the surface of DLM III's rear panel. Depressing this momentary acting switch initiates the unit's diagnostic routine, and the microprocessor executes the same program that is used when DLM III is powered up. This key can also be used as a reset switch since it has the same function of turning the unit off then on again.

2-5-4-3. Operating Power Controls

The following paragraphs contain functional descriptions of DLM III's operating power controls. Paragraph 2-2 contains instructions for changing the voltage select switch setting and the contents of the fuseholder.

The voltage select slide switch is used to configure DLM III's power supply for operation at either 115 or 220 VAC. Set the slide switch to the position corresponding to the operating voltage available; refer to paragraph 2-2.

The POWER switch is used to apply operating power to DLM III. The unit can operate using either 115 or 220 VAC, 50 or 60 Hz. Any combination of voltage and frequency can be used if the correct fuse is installed in the fuseholder, and the voltage select switch is positioned to the proper setting.

The fuseholder must contain a 1.5 A slow-blow fuse if DLM III is operated using a source of 115 VAC. If a 220 VAC source is used, then the fuseholder must contain a 0.75 A slow-blow fuse.

A frequency select plug is used to configure DLM III's video display refresh circuitry for operation at either 50 or 60 Hz. This plug is set at the factory according to the unit's destination, unless specified otherwise by the customer. If units must be reconfigured, the plug must be rotated to the proper orientation. The frequency select plug is located inside the unit, on the large central processing unit printed circuit board; see Figure 2-3 and refer to paragraph 2-2.

If no unique configuration is specified by the customer when DLM IIIs are ordered, units shipped to destinations in North America are configured at the factory to operate using a source of 115 VAC at 60 Hz, and units shipped outside of North America are configured to operate using 220 VAC at 50 Hz. However, operators can change the configuration at any time by using the functional descriptions provided in this paragraph along with the directions contained in paragraph 2-2.

CHAPTER 3

OPERATION

3-1. INTRODUCTION

This chapter describes how to prepare DLM III for communications network testing. The unit uses menus to provide the operator with lists of operating parameters during setup for test operations. Included in this chapter are instructions for interfacing DLM III with the communications network, and for selecting among the menu's operating parameters.

3-2. INTERFACE CONNECTIONS

DLM III is connected into a communication system between the terminal equipment (DTE) and communications equipment (DCE). Power can be applied to DLM III before it is connected into the system; however, the following paragraphs describe applying power after connecting the unit for illustration purposes.

All system interface connectors are located on DLM III's rear panel; see Figures 2-1 and 3-1, and refer to paragraph 2-5. The terminal equipment connects to DLM III at connector TO DTE, and the communications equipment at connector TO DCE. Both connections are made through EIA interface cables. After these two connections are made and DLM III is operating in the passive state, it is essentially transparent to the line (Figure 3-1), and data flows through the unit without being modified.

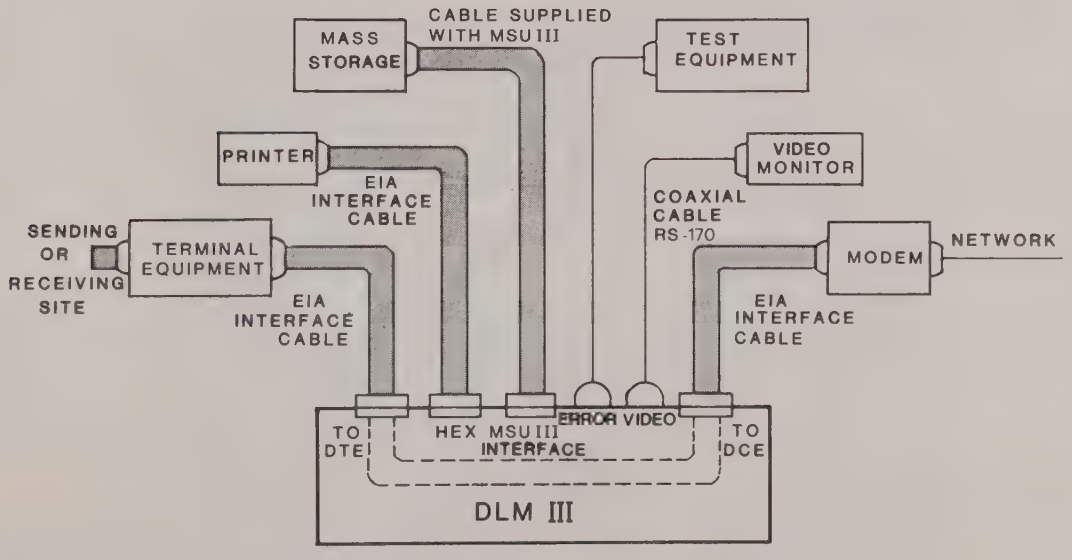


FIGURE 3-1. SYSTEM INTERFACE AND EXTERNAL EQUIPMENT CABLE CONNECTORS

If a printer or other serial ASCII device is used with DLM III, it is connected to DLM III at connector HEX OUT via a standard EIA RS-232-C cable. Connector MSU III INTERFACE is used to connect a mass storage device (DIGILOG's MSU III), through a 15-pin cable to DLM III.

Coaxial cables terminated with standard BSC connectors are used to connect test equipment and a video monitor to the ERROR OUTPUT and VIDEO connectors. Connector ERROR OUTPUT provides a TTL-compatible pulse to test equipment when a parity error is detected, a trap sequence occurs, or key ERROR RESET (located on DLM III's front panel) is depressed. Connector VIDEO provides a standard RS-170 composite video output signal to as many as ten monitors located up to 2000 feet from the unit

3-3. APPLYING POWER

Apply operating power to DLM III by setting the unit's rear panel POWER switch to ON; see Figure 2-1. DLM III automatically performs both a lamp-test of all LEDs (except those on the breakout panel) and a diagnostic self-test each time it is turned on. Upon successful completion of the self-test, the following message (with blinking prompt) appears on the video display:

```
PASSED  X DIAGNOSTICS                 (X = current software revision)
DEPRESS "MENU SEL" TO CONTINUE        (blinking prompt)
```

If a RAM failure occurs during the self-test, the following error message appears on the video display:

```
RAM ERROR
DEPRESS "MENU SEL" TO CONTINUE        (blinking prompt)
```

A RAM failure does not mean that the unit cannot be used; however, a RAM failure may cause an incorrect indication during system testing. If the RAM error message is displayed, have DLM III repaired as soon as possible to avoid problems during system testing.

3-4. MENU SELECT OPERATION

The following paragraph contains information on how to set up parameters on the DLM III. A thorough discussion pertaining to the use of the "DON'T CARE" characters is also included.

3-4-1. GENERAL INFORMATION

After the self-test is satisfactorily completed and key MENU SEL is depressed, the first page of the menu appears on the video display; see Figure 3-2 for an example. This and all other menu pages contain protected and unprotected variable fields that provide the operator with a variety of operating parameter choices.

A blinking block cursor is used during menu select operation and appears at the first character position of menu page one's first variable field. A message displayed at the bottom of the screen prompts the operator to depress key FIELD SEL to select the next parameter available in the field containing the cursor.

In unprotected variable fields, the operator can enter data characters using the hexadecimal keypad. These fields are displayed half intensity, and at initialization they contain "don't care" characters.

DLM III uses "don't care" characters for several purposes, and their meaning depends upon the purpose that they are used for. One application of "don't care" characters is to provide video blanks (spaces) on the screen between displayed data characters. For example, when capture buffer data are displayed using the "FDX EXP" (full duplex, expanded) feature, the displayed characters are separated by blank spaces for easier reading. The video blanks used to separate the capture buffer's data have no hexadecimal or time value; they are inserted by DLM III only to make the display easier to read.

"Don't care" characters are also used to provide a timing relationship between data characters in a stream of data captured by DLM III. When capture buffer data are displayed using either the "FDX EXP" or "FDX COMP" (full duplex compressed) features, gaps may occur in the stream of data. That is, there may be a period between transmitted characters when no data are received by DLM III's capture buffer even though the line is active. In this case, the gaps between the received characters are indicated on the screen as blank spaces between the displayed characters. In "FDX EXP" operation, these blank spaces occur in addition to the spaces inserted for expanding the display.

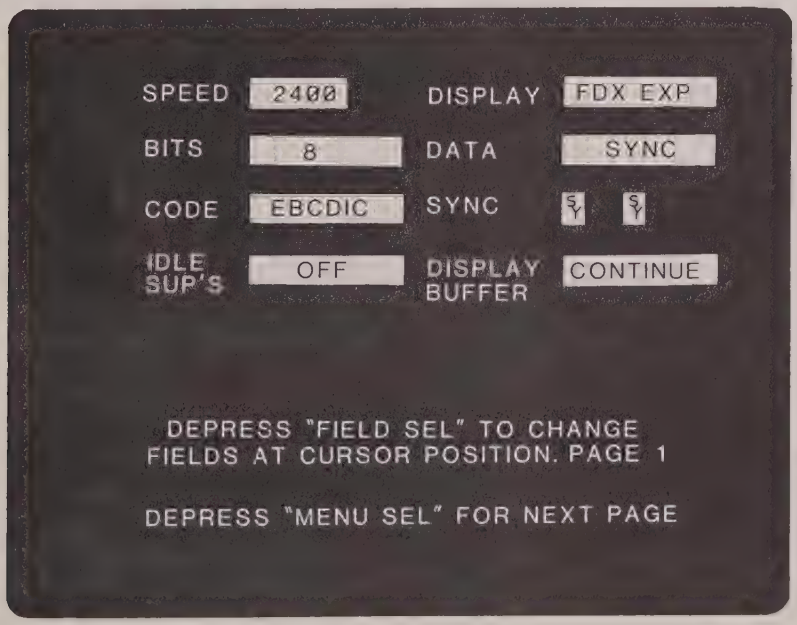


FIGURE 3-2. MENU PAGE 1; REPRESENTATIVE ILLUSTRATION

The blank spaces used to indicate gaps in received data have a time value in the data stream, but they do not have a hexadecimal value. These blank spaces are also formed by "don't care" characters generated within DLM III and inserted between the capture buffer characters when they are sent to the unit's video display circuitry.

"Don't care" characters are also used in the unprotected variable fields of the menu to indicate to the operator that data can be entered into the field, and to indicate to DLM III's circuits that no data are present (none entered by the operator) in the field. For example, menu fields "sync," "out sync," and "trap" contain "don't care" characters that appear as video blanks when DLM III is initialized. If the operator does not enter data into these fields, then DLM III treats the "don't care" characters as characters having no hexadecimal value.

In some cases, DLM III requires characters other than "don't cares" in a field for proper operation. For instance, if the "sync" field contains "don't cares," and the unit is configured for synchronous operation, then the unit cannot synchronize with the system. As a result, captured data are shown half intensity on the screen to indicate that DLM III isn't in sync with the line.

"Don't care" characters can have an important positional value in relation to the data stream; such as when used in the menu's "trap" field. DLM III interprets this field on a character-by-character basis from right to left; that is, the field is right justified (see Figure 3-3). When the "trap" feature is selected, DLM III searches the line for the exact sequence of characters contained in field "trap." In the example shown in part 1 of Figure 3-3, the trap event takes place when the character sequence ABC occurs on the line. However, in the example shown in part 2 of the figure, the trap takes place when sequence A_BC occurs. In this case, character _ can be any character in the system's code since _ is a "don't care" character entered by the operator.

The DLM III is not specially equipped to handle codes that are not of eight bits; nevertheless, traps can still be performed. After the unit's parameters have been selected and data has been captured, the operator must proceed to the capture buffer screen and find the characters to be trapped on. The user must then use the HEX key to observe the character conversion into hex and make note of the value. Then, it is necessary to return to menu page 1 and change the bit pattern to "8." Following this operation, it is necessary to return to the capture buffer and depress the HEX key once more. The character value after conversion is the character to be entered into the trap field. After this procedure has been completed, it will be necessary to change the bit pattern back to its original configuration.

"Don't care" characters are used in nearly the same way in DLM III's output menu. Here they are used to indicate unprotected variable fields, and they are significant if they are left in the field when key RUN is depressed. For example, when key CLEAR is depressed while the cursor is at the beginning of field "sec," "don't care" characters fill the field. These "don't cares" prevent (disable) the transmission of messages from the buffer on the basis of a time interval.

However, if field "sec" is filled with zeros (0s), DLM III then transmits messages with a minimum time delay between contiguous messages; that is, no longer intermessage time than one character's duration at the current baud rate.

"Don't care" characters are significant when used in the output menu's "buffer" and "out fox" fields. In the "buffer" field, "don't cares" can be entered by the operator within a message to insert spaces between characters in the buffer. These spaces do not occur between characters when the message is transmitted; however, the spaces permit the operator to alter the message at a later time by inserting data characters in their place.

In the "out fox" field, "don't care" characters can be entered either within the header or trailer segments, or behind data already entered in these two segments. Header and trailer character data are right justified within their fields. As a result, if the right-most character in these fields is a "don't care" character it has no time or hexadecimal value in the transmitted message. Later, the operator can enter data characters in these spaces to alter the header or trailer information.

When characters are entered in multicharacter, unprotected variable fields, the cursor automatically moves to the next character position within the field after a character is completed. The cursor moves to the first character position of the next variable field, protected or unprotected, when the last available character position within a field is filled.

The operator can control the cursor's movement by using DLM III's front panel cursor control keys; see Figure 2-3. Depressing any one of these keys causes the cursor to move in the direction indicated by the key's legend. Except when viewing capture buffer data, depressing key HOME causes the cursor to go to the first available character position in the field closest to the upper left corner of the display. When viewing capture buffer data, depressing HOME positions the cursor over the character located at the beginning (front) of the buffer.

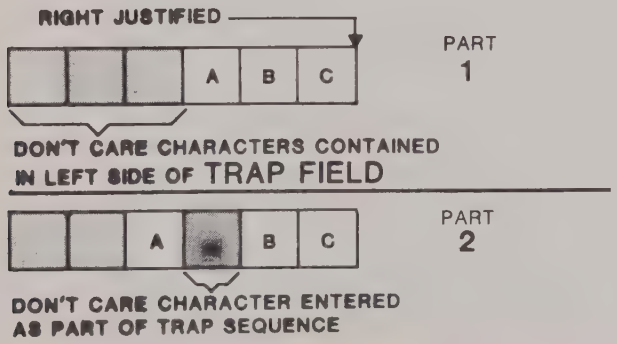


FIGURE 3-3. "DON'T CARE" CHARACTERS; TRAP FIELD ILLUSTRATION

Moving the cursor from field to field will not change or destroy the menu fields' contents. Parameters can be changed, and/or data can be entered while paging through the menu; but DLM III's operating program does not change until DLM III's operating state is changed from either run to halt, or halt to run.

Menu select operation is explained in more detail in the following paragraphs, which also describe the contents of each page of the menu.

3-4-2. MENU CONTENTS; PAGE 1

CAUTION

AS IS TRUE FOR ALL FIELDS IN THE MENU'S PAGES, THE PARAMETER VALUE SHOWN IN A FIELD AFTER THE CURSOR LEAVES THE FIELD, OR AFTER DEPRESSING EITHER KEY MENU SEL OR KEY RUN HALT, IS THE OPERATING PARAMETER USED BY DLM III.

SPEED

DLM III initializes to 2400 baud, and parameters available are:

50	134.5	600	1800	3600	9600	OTHER
75	150	1050	2000	4800	19.2k	
110	300	1200	2400	7200	EXTERNAL	

"Other" is displayed in an unprotected variable field, and parameter data are entered in the field using the decimal portion of the keypad. Any speed parameter that is a multiple of 1 and greater than 28 baud can be entered. However; there are upper limits on the baud rate data entered into this field.

DLM III's operating mode defines the upper limit of the baud data entered into "other" by the operator. In the monitor (passive) mode, the upper limit is 59,999; and in the output (active) mode the limit is 19,999. In both cases, if a number exceeding the upper limit is entered into the field, the following error message is displayed:

"SPEED TOO HIGH"

Field "other" is automatically cleared to all zeros when the error message is displayed.

DLM III supplies its own character timing when operated in all but parameter "external." If the "external" option is selected, timing (clocking) must be provided to DLM III by either the data terminal or data communication equipment.

CAUTION

IF THE MODEM IS SUPPLYING CLOCKING ON PINS 15 AND 17, "EXT" SHOULD BE SELECTED REGARDLESS OF BAUD RATE.

DISPLAY

DLM III initializes to "FDX EXP" (full duplex expanded, see Figure 3-4) and parameters available are:

FDX EXP.....Full duplex expanded; 256 characters are displayed and seperated by video spaces that are "don't care" characters for easier reading. Transmit and receive data are shown on separate lines; receive data are underlined.

FDX COMP....Full duplex compressed; 512 characters are displayed side-by-side. Transmit and receive data are shown on separate lines; receive data are underlined.

HDX.....Half duplex; both transmit and receive data are displayed on the same line. Receive data are displayed underlined.

SEND.....Send only; transmit data displayed are characters at pin 2 of the EIA interface.

RECEIVE.....Receive only; receive data displayed are characters at EIA interface pin 3. Receive data are displayed underlined.

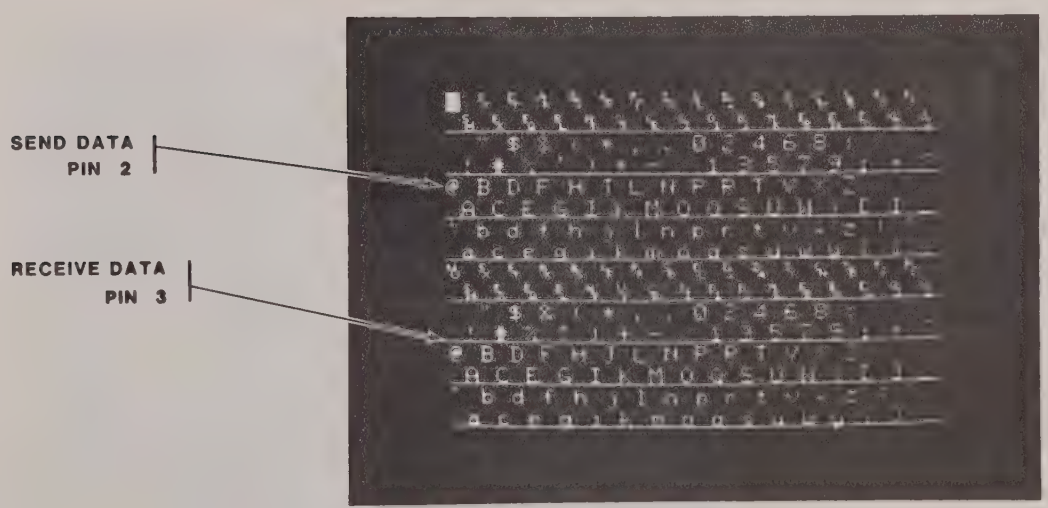


FIGURE 3-4. SELECTABLE VIDEO DISPLAY PARAMETERS; PART 1, FULL DUPLEX EXPANDED (ALPHANUMERIC)

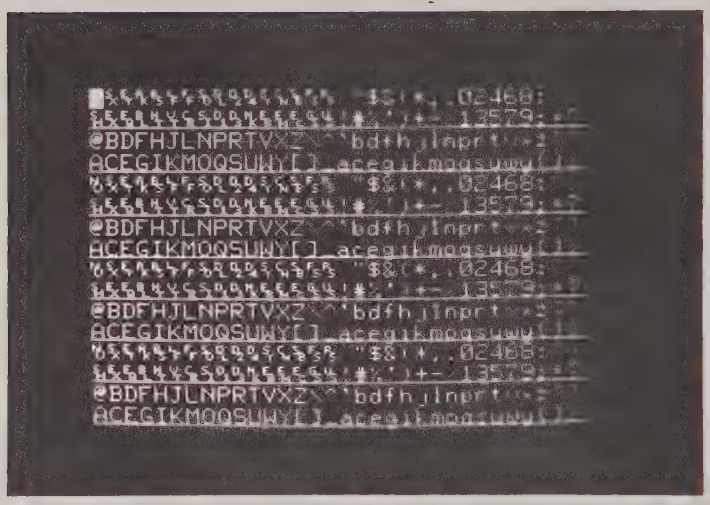


FIGURE 3-4. SELECTABLE VIDEO DISPLAY PARAMETERS;
PART 2, FULL DUPLEX COMPRESSED (ALPHANUMERIC)

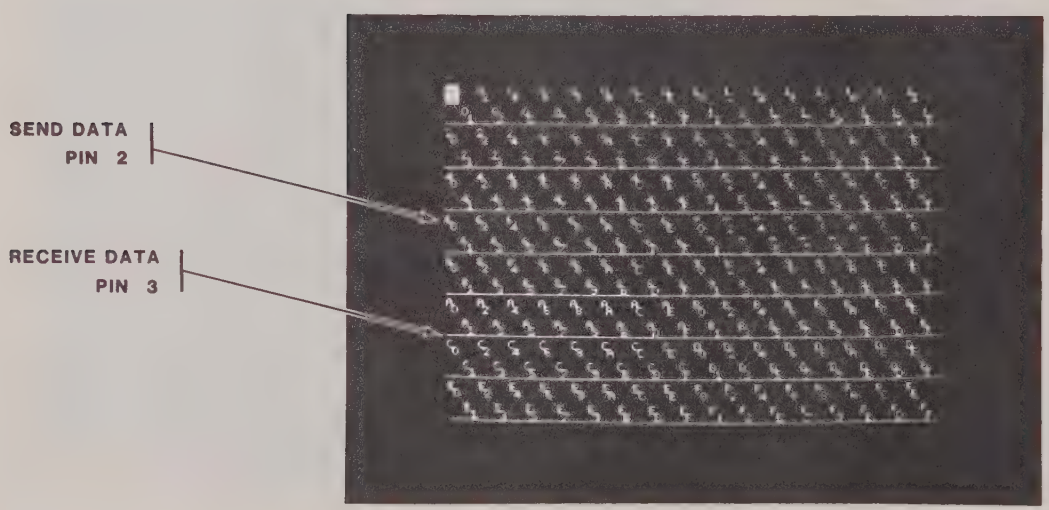


FIGURE 3-4. SELECTABLE VIDEO DISPLAY PARAMETERS;
PART 3, FULL DUPLEX EXPANDED (HEXADECIMAL)

BITS

The number in this field determines the number of bits per character, with parity, used by DLM III. DLM III initializes to use 8-bit characters, and parameters available are:

5	7	9	NOTE:
6	8	STREAM	STREAM is used for sync capture only.

In asynchronous operation, DLM III uses the first space in a line of data to establish timing by mid-bit sampling. In synchronous operation, data bits are timed using the supplied clock pulses' trailing edges.

If "stream" is selected, data bits are loaded into the capture buffer without framing. After the data bits are loaded and the unit is halted, the bits can be shifted using the cursor control keys. Data bits are shifted one bit at a time, to the right, each time a cursor left or right key is depressed.

Data bits can also be decreased after loading. In this case, the last bit received is displayed as a zero.

DATA

DLM III initializes for synchronous operation, and parameters available are:

ASYNC 1	ASYNC 2	SDLC DIR
ASYNC 1.5	SYNC	SDLC NRZI

In asynchronous operation, DLM III properly sends and receives data using 1 ("async 1"), 1.5 ("async 1.5"), or 2 ("async 2") stop bits.

In synchronous operation, DLM III can be synchronized using one or two sync characters. In addition, the sync characters can be either the same or two different characters.

In both the "SDLC DIR" and "SDLC NRZI" states, synchronization begins when a flag character (HEX 7E) is received. A single 7E (HEX) is displayed to designate each message. Inserted zeros are automatically removed for display data and added for output data. DLM III does provide automatic flag idle supression.

Asynchronous data can also be sent and received using isochronous methods; that is, by either using an external timing source or by setting up DLM III to operate as a synchronous DCE. In this case, "async 1.5" cannot be selected.

SYNC

This field's characters define the synchronizing characters used by DLM III for proper protocol operation. DLM III initializes with this unprotected variable field blank. Blank characters in this field are treated as don't care characters; refer to paragraph 3-4-1.

Synchronous operation requires character framing to start when DLM III detects a specific sync character sequence. Any two identical or different characters can be entered in field "sync" using the hexadecimal keypad, but a single sync character can also be used. DLM III displays data even if the character(s) in field "sync" are not found.

Data captured by DLM III when it is synchronized are shown full intensity on the screen. Data captured when DLM III is not synchronized are shown half intensity to indicate that the unit is searching for sync characters.

CODE

DLM III intializes to use the ASCII code (the letters ASCII appear in the field), and codes available are:

EBCDIC	OPTION 1
ASCII	OPTION 2

Codes "option 1" and "2" are defined by the user when DLM III is purchased or they can be added at a later date. Any 5-, 6-, 7-, or 9-bit codes can be added as options.

If the user has optional codes available in DLM III, the name of the codes will appear in place of "option 1" and "option 2." Contact DIGILOG for a listing of all optional codes currently available.

DISPLAY BUFFER

DLM III initializes to "continuous," and the remaining operating parameters are "stop full" and "stop imm" (stop immediate).

In "continuous" operation, the capture buffer is loaded under control of key RUN HALT. Depressing this key the first time places DLM III in the run state and data are continuously loaded into the capture buffer. Depressing key RUN HALT the second time halts the unit, and the capture buffer stops loading data.

In "stop full" operation, DLM III starts loading data the first time key RUN is depressed. However, the capture buffer stops loading data after 8k of characters are loaded and then DLM III automatically halts. At the same time, the RUN indicator turns off and the HALT and BUFF FULL indicators turn on; refer to the "trap" field description contained in paragraph 3-4-3.

If a trap condition is set up, and field "search" is set to send, receive, or both, then the buffer will continue to load data until the trap is found. In this case, DLM III automatically halts when the buffer has loaded approximately 4k characters after the trap sequence.

In "stop imm" operation, DLM III starts loading data the first time key RUN is depressed. However, the capture buffer stops loading data when either a CRC/LRC error or trap is found. DLM III then automatically halts, the RUN indicator turns off, and the HALT indicator turns on.

IDLE SUP'S

DLM III initializes with idle suppression ("idle sup's") set to "mark," and the other parameters available are "off," "space," and "sync." With idle suppression "off," all characters available at the communications interface are loaded into the capture buffer.

Selecting "mark" prevents all mark characters (HEX FF) occurring at either side of the interface from being loaded into the capture buffer. Selecting "space" prevents space characters (HEX 00) occurring at either side of the interface from being loaded into the buffer. Selecting "sync" prevents characters that are identified in the menu's "sync" field from being loaded into the capture buffer. However, if two different characters are entered in the "sync" field, then only the first character is suppressed.

3-4-3. MENU CONTENTS; PAGE 2

As is true for all menu page fields, the parameter value shown in a field after the cursor leaves the field, or after keys MENU SEL or RUN HALT are depressed, is DLM III's operating parameter. Figure 3-5 shows an example of menu page 2.

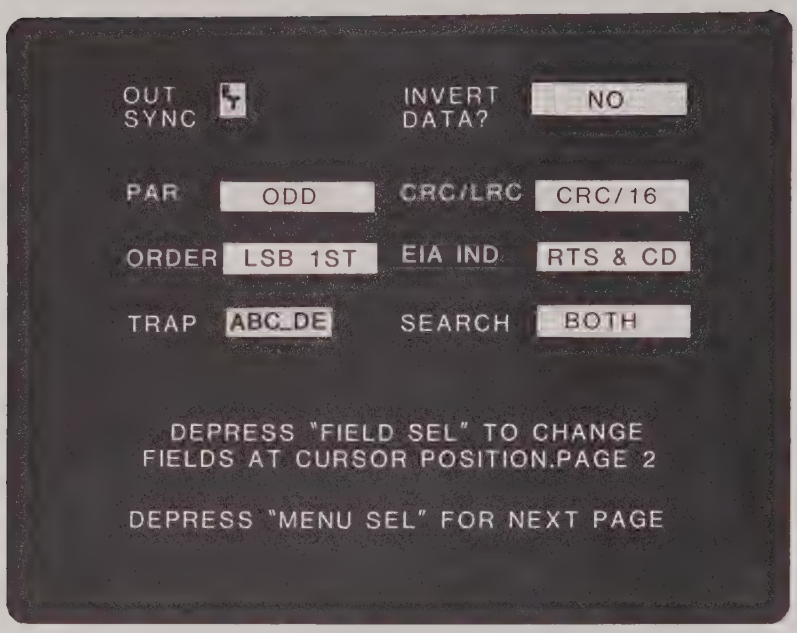
OUT SYNC

Field "out sync" is intended to be used when DLM III is connected in communication systems that employ binary synchronous communications data link control (BSC DLC). A match of the character contained in this field with a captured character causes DLM III to drop sync and begin searching for the data link's next sequence of sychronizing characters. In most cases, an EOT or an FF should be entered in this field.

CAUTION

NEVER ENTER THE SYSTEM'S SYNC CHARACTER IN FIELD "OUT SYNC"

This field should contain a "don't care" character if the system's BSC DLC inserts more than four pad characters between character EOT and the next sync characters during a polling sequence; see Part 1 of Figure 3-6.



CAUTION

NEVER ENTER THE SYSTEM'S SYNC CHARACTER IN FIELD "OUT SYNC"

FIGURE 3-5. MENU PAGE 2; REPRESENTATIVE ILLUSTRATION

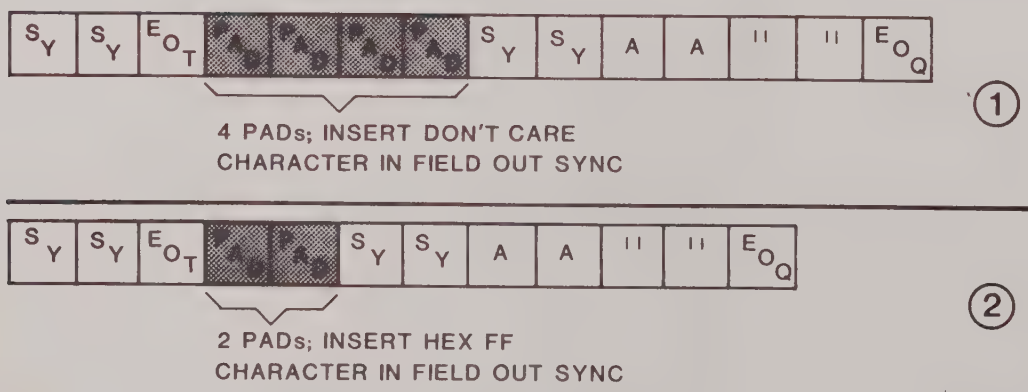

SY SY EOT PAD PAD PAD PAD SY SY A A II II EOQ
4 PADs; INSERT DON'T CARE CHARACTER IN FIELD OUT SYNC
1
SY SY EOT PAD PAD SY SY A A II II EOQ
2 PADs; INSERT HEX FF CHARACTER IN FIELD OUT SYNC
2

FIGURE 3-6. DON'T CARE CHARACTERS; BINARY SYNCHRONOUS DATA LINK CONTROL (BSC DLC) ILLUSTRATION

When four pad characters are detected after character EOT, DLM III automatically drops sync when it detects the fourth sequential pad character and immediately begins searching for the next sync character (SY of Figure 3-6).

Field "out sync" should contain a pad character (HEX FF) if the BSC DLC does not insert exactly four pad characters between characters EOT and next SY; see part 2 of Figure 3-6. When DLM III detects a pad character following an EOT, the pad character is compared with the contents of field "out sync." DLM III automatically drops sync when pad characters are matched, and the unit then begins searching for the next SY character group.

The following is a typical example of the need to place a pad character (HEX FF) in field "out sync." It is based on circumstances that usually occur in systems employing IBM 3270 (370X) and airline IPARS/SABRE protocols (this last type of code uses 00 or ID IN OUT sync fields).

Assume that DLM III displays some, or all, poll sequences where the character string SY SY EOT is shown correct, but the poll address characters (command and ENQ) are garbled. This type of garbling is usually the result of an insufficient number of pad characters being inserted between the messages to re-sync the unit. The garbling can be eliminated by entering a pad character (HEX FF) in field "out sync." This pad character causes DLM III to re-sync on the poll address characters following the SY SY EOT character string.

During synchronous operation, regardless of the form of DLC used by the system, DLM III automatically drops sync and begins searching for sync characters after detecting either four mark bytes (HEX FF) or 32 mark bits. In addition, DLM III's screen displays captured data in half intensity until the unit is synchronized with the line.

DLM III ignores the contents of field "out sync" when the unit is operated in an asynchronous configuration.

INVERT DATA?

DLM III initializes to not invert data, and the word "no" appears in this field. The remaining selection is "yes." If "yes" is selected, all data are inverted at both the input to and output from DLM III; that is, one bits are changed to zero bits, and zero bits are changed to one bits. Selecting "yes" enables DLM III to be used in systems that are not EIA RS-232-C compatible.

PAR

DLM III initializes with no parity specified, and the word "none" appears in this field. Parameters available are:

NONE	EVEN	ALL ONES
ODD	ALL ZEROS	

When the initial selection ("none") is specified in this field, DLM III does not perform any parity tests. If one of the parity tests is selected, DLM III checks each character for correct parity. Characters failing a parity test are shown blinking on the screen and cause indicator PARITY ERROR to light.

CRC/LRC

DLM III initializes with no block check specified, and the word "off" appears in this field. Parameters available are:

OFF	FCS SDLC	OPTIONAL
CRC/16	LRC/8	

When the initial selection ("off") is specified in this field, DLM III does not perform block check calculations. If one of the checks is selected, DLM III calculates a block check character for each message loaded.

Control character DLE plus any characters entered into menu page one's "sync" field are excluded from calculations if CRC/16 is selected and DLM III is operated in the monitor (passive) mode. Character STX is excluded from calculations if LRC/8 is selected and the unit is operated in the monitor mode.

Calculation of a block check character that does not match the check character found in the captured data causes the failed sequence of characters to be shown blinking on the screen, and turns on indicator CRC/LRC ERROR.

The polynomials used by DLM III to calculate check characters are:

$$\text{CRC/16: PRESET 0, } (X)^{16} + (X)^{15} + (X)^{2} + 1$$

$$\text{FCS/SDLC: PRESET 1, } (X)^{16} + (X)^{12} + (X)^{5} + 1$$

$$\text{LRC/8: } (X)^{8} + 1$$

ORDER

DLM III initializes to show the least significant bit ("lsb") of each character first. The remaining selection shows the most significant bit ("msb") first. This field's contents can be changed after the capture buffer is loaded.

EIA IND

DLM III highlights in reverse video a selected interface parameter. DLM III initializes to not display in reverse video characters associated with parameters specified in this field; that is, this field shows the word "off" at initialization. Parameters available are:

RTS.....DLM III indicates signals RTS and send data. Characters occurring after RTS goes true are displayed reverse video.

CD.....DLM III indicates signals CD and receive data. Characters occurring after CD goes true are displayed reverse video.

RTS & CD.....DLM III indicates signals RTS, CD, as well as associated send and receive data. Characters concurring with RTS and CD appear reverse video.

TRIG + & -.....DLM III indicates both interface signals as well as data. Characters occurring after, or between, signals patched to the TRIG (+) and/or TRIG (-) connectors are displayed reverse video.

TRAP

DLM III initializes with this unprotected variable field blank; that is, full of "don't care" characters having no hexadecimal value (refer to paragraph 3-4-1, and see Figure 3-3).

Before a trap sequence can begin, a character sequence must be identified that defines where in the data the trap event will occur. The characters entered into this field using the hexadecimal keypad identify those characters about which the trap sequence occurs.

Six or fewer characters can be entered in this field, and key DON'T CARE can be used to enter characters having no hexadecimal value. Character positions left empty in this field are treated as "don't care" characters.

Trap sequence characters found in data captured by DLM III are shown blinking on the video display.

If the "trap" feature is selected along with the display buffer's "continuous" feature, and DLM III is capturing or transmitting data, then DLM III will not halt until key RUN HALT is depressed. For example, if both "trap" and "continuous" are selected together, DLM III will not automatically halt when the trap sequence is detected; refer to paragraph 3-4-2, DISPLAY BUFFER.

However, if the display buffer's "stop full" feature is selected along with the "trap" feature, key RUN HALT does not have to be used to halt DLM III. DLM III automatically halts after the trap sequence is detected, all the buffer's storage locations are filled, and the following three conditions are present:

1. If the trap sequence occurs before DLM III's capture buffer is half full, less than approximately 4000 characters, then it halts after the buffer is completely loaded. In this case, it is possible for the trap sequence to appear near the beginning of the buffer's storage locations.

2. If the trap sequence occurs after the capture buffer is more than half full, then DLM III continues loading data into the capture buffer until the trap sequence appears in the middle of of the buffer. In this case, DLM III operates in a "continuous" display buffer mode and the captured trap sequence is followed by 4000 characters before automatically halting.

3. If the trap sequence occurs, and the display buffer's "stop imm" mode has been selected, then DLM III halts immediately; the trap sequence appears near the end of the capture buffer.

SEARCH

DLM III initializes with this operating parameter set to "off," and the remaining selections are "send," "receive," and "both." When this field is set to "off," characters can be entered into the "trap" field without a trap actually occurring. Selecting one of the other three parameters determines which side of the line DLM III searches for the trap sequence; however, both sides of the line cannot be searched if DLM III is operated at 19.2 kbps.

3-4-4. MENU CONTENTS; PAGE 3

If DLM III is not equipped for output, this menu page is not available, and the following message appears on the screen when key MON OUT is depressed:

"NOT EQUIPPED"

The message is displayed for four seconds. The display then reverts to show either a previously displayed menu page or captured data.

If DLM III is equipped with output circuits, the OUT indicator next to key MON OUT lights when the key is depressed. Page three of the menu, the output page, is displayed following pages one and two. That is, the first two menu pages are seen again before page three appears.

Changes can be made to the operating parameters while paging through the menu, or the menu's contents can be left unchanged. As is true for all fields in the menu's pages, the parameter value shown in a field after the cursor leaves the field, or after either the MENU SEL or RUN HALT key is depressed, is DLM III's operating parameter.

Menu page three's output parameters are described in the following paragraphs, and Figure 3-7 shows an example of menu page 3.

ACT AS

DLM III initializes to simulate a synchronous modem, and "sync DCE" appears in this field. The remaining selections are "async DCE" and "DTE." If "sync DCE" is selected, DLM III supplies timing on interface pins 15 and 17.

If "async DCE" is selected, DLM III acts as an asynchronous modem and does not provide clock pulses. If "DTE" is selected, DLM III simulates a terminal or communications controller. If "dte" is selected and field "speed" shows "external," clock pulses must be present on interface pins 15 and 17 for DLM III to operate properly; refer to paragraph 3-4-2, SPEED.

MODE

DLM III initializes with this parameter set to "off," and no message is selected for transmission from the unit. The three message modes available are "out fox," "buffer," "bert 511."

When "off" is selected, DLM III simulates the selection shown in field "act as"; refer to ACT AS above. The unit supplies the appropriate EIA handshaking signals to the interface, but message transmission does not occur.

Selecting "out fox" causes the "fox" message to appear on the screen, below the variable fields; see Figure 3-8, Part 1. The "fox" message is contained in a protected field that has a 10-character, unprotected field ahead of it and a 6-character, unprotected field behind it. The 10-character field can be used for header data, and the 6-character field for trailer data. CRC/LRC calculations, however, cannot be automatically added to the "out fox" message.

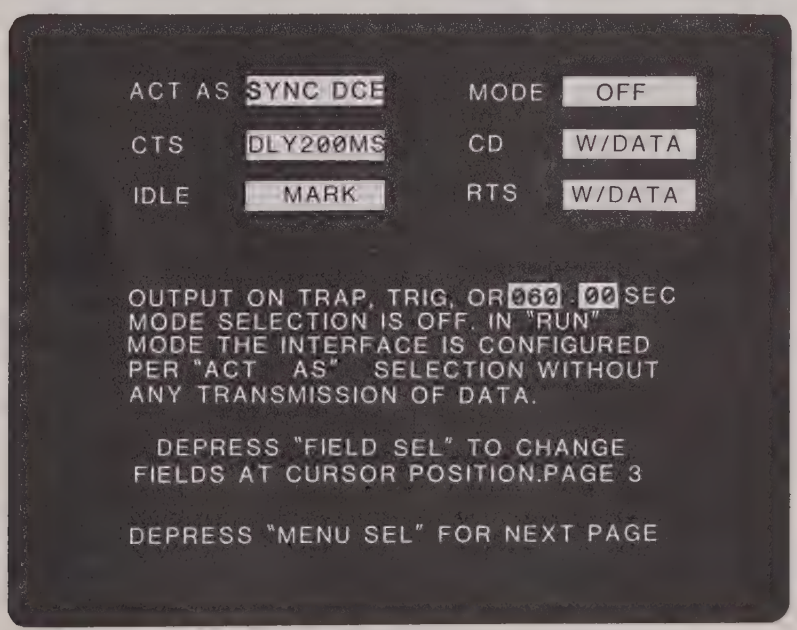


FIGURE 3-7. MENU PAGE 3; REPRESENTATIVE ILLUSTRATION

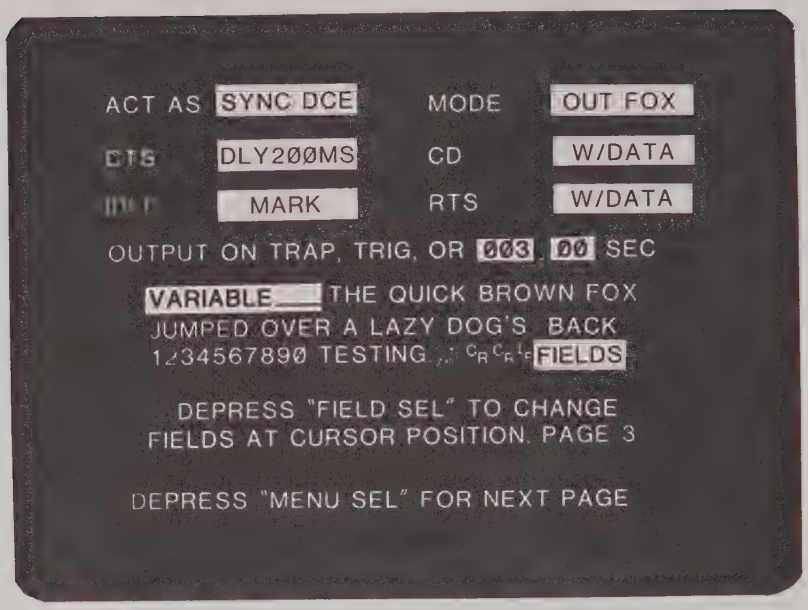

ACT AS SYNC DCE
MODE OUT FOX
CTS DLY200MS
CD W/DATA
IDLE MARK
RTS W/DATA
OUTPUT ON TRAP, TRIG, OR 003 . 00 SEC
VARIABLE THE QUICK BROWN FOX
JUMPED OVER A LAZY DOG'S BACK
1234567890 TESTING FIELDS
DEPRESS "FIELD SEL" TO CHANGE
FIELDS AT CURSOR POSITION. PAGE 3
DEPRESS "MENU SEL" FOR NEXT PAGE

FIGURE 3-8. SELECTABLE OPERATING MODES;
PART 1, MENU PAGE 3 (FOX MESSAGE)

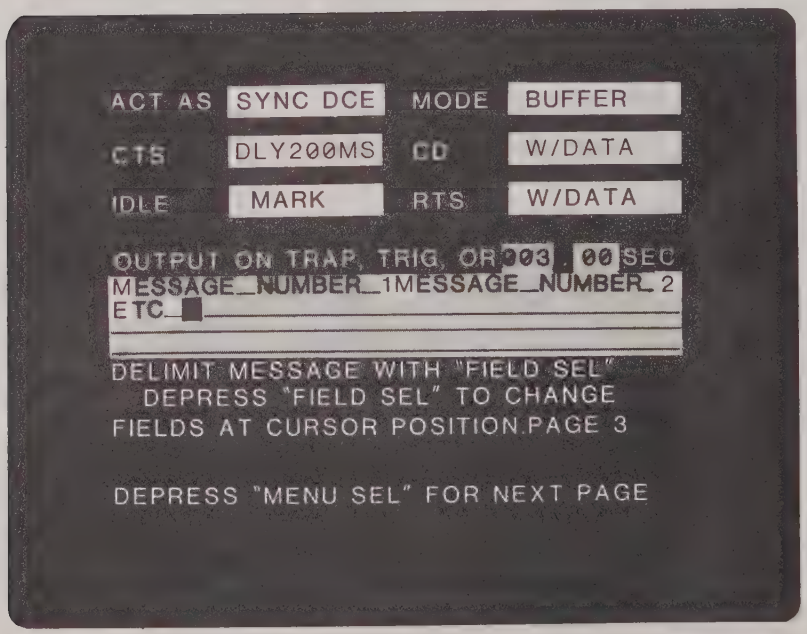


FIGURE 3-8. SELECTABLE OPERATING MODES;
PART 2, MENU PAGE 3 (BUFFER)

To enter data in these fields, use the cursor control keys to position the cursor within the field, and enter data characters at the cursor position using the hexadecimal keypad. Key DON'T CARE can be used to enter "don't care" characters, although character positions left blank are treated as "don't cares"; refer to paragraph 3-4-1.

Selecting "buffer" causes a 128-character, unprotected field to appear on the screen, just below the variable fields; see Figure 3-8, Part 2. This field is used to assemble up to 64 message segments. To enter data in this field, use the cursor control keys to position the cursor within the field. Characters are then entered using the hexadecimal keypad and key DON'T CARE.

Selecting "bert 511" causes a 511-bit, sync or async, pseudorandom sequence code to be prepared for transmission from DLM III; see Figure 3-8, Part 3. Selecting this test code causes a status message to appear at the bottom of the screen after key RUN HALT is depressed:

RUN TIME XX **MIN** XX.X **SEC** **TEST 511**
BIT ERROR XXXX **BLOCK ERROR** XXXX

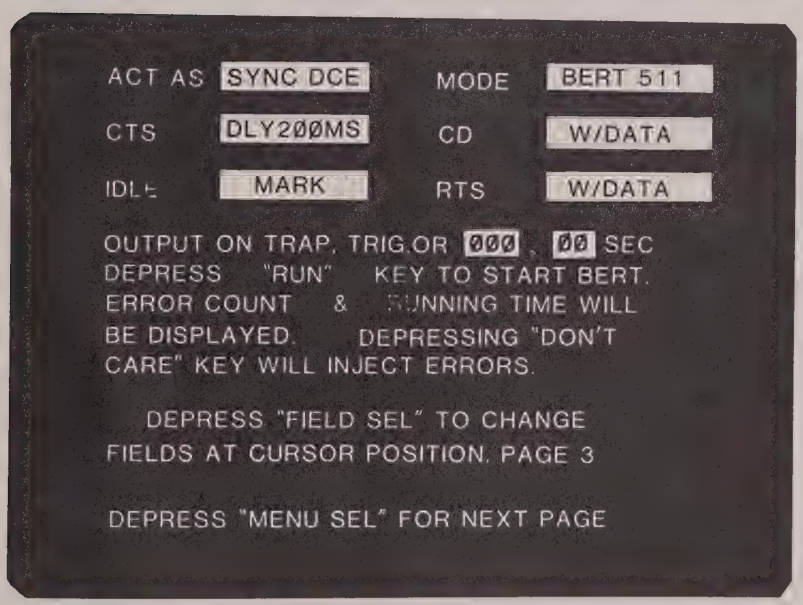


FIGURE 3-8. SELECTABLE OPERATING MODES;
PART 3, MENU PAGE 3 (BERT 511)

Errors can be injected into this test code by depressing key DON'T CARE while the test code is being transmitted. Errors should be injected into the test code from time to time to ensure that DLM III's bit error-rate test (BERT) circuits are operational, as well as to ensure that the line has not completely opened. Paragraph 4-4-5 contains a description of how to set up and perform a BERT.

CTS DELAY

DLM III initializes to provide a 200 millisecond ("200 ms") delay between receiving RTS and sending CTS when configured to act as a modem; either "sync dce" or "async dce" (refer to ACT AS above). The remaining selections are "0 ms," "10 ms," and "50 ms."

CD

DLM III initializes to provide CD with receive data ("w/data") when configured to act as a modem. Selecting "constant" provides continuous CD.

IDLE

DLM III initializes to mark the line ("mark") while idling and acting as either a modem or terminal. Other parameters available are "sync," and "flag" (HEX 7E). A space hold is provided if the inverted data option is selected; refer to paragraph 3-4-3, INVERT DATA?.

RTS

DLM III initializes to provide RTS with send data ("w/data") when configured to act as a terminal. Selecting "constant" provides continuous RTS while DLM III is waiting for CTS.

3-5. CALCULATING CRC AND LRC CHARACTERS

The following facts must be remembered when calculating a CRC/LRC character for a message that is to be sent from DLM III:

1. The sync character(s), or any other characters shown in menu page 1's "sync" field, normally won't be included in the CRC/LRC calculation. If these characters are to be included then the "sync" field has to be blank; that is, filled with video spaces entered by depressing either key DON'T CARE or CLEAR while the cursor is at the character positions.

2. Generate the CRC/LRC character prior to segmenting the buffer since the same delimit character is used in both operations. CRC/LRC generation can be done after segmenting; however, the delimit characters must be returned to their original locations.

(Continued)

3. Identify the first and last characters included in the CRC/LRC calculation by placing the cursor over these characters and depressing the FIELD SEL key. This action inserts delimiters in the message.

4. FSC/SDLC is automatically calculated when entered into the menu; no further action is required.

The following paragraphs contain the procedure recommended for entering data and generating the correct CRC/LRC character for messages, or message segments, that are to be sent from DLM III using the 128-character buffer.

Enter characters that are going to be transmitted into the buffer's field. Note the prompt at the bottom of the screen:

"DELIMIT MESSAGE WITH FIELD SEL"

After all character data are entered, use the cursor control keys to move the cursor over the first character in the message that is to be entered into the calculation; usually the first data character after character STX or SOH. Depress key FIELD SEL while the cursor is over the character. The character is now displayed full intensity (highlighted) to identify it as the first character to be included in the CRC/LRC calculation; see Figure 3-8, part 2.

Next, move the cursor over the last character to be included in the calculation, usually the ETX or EOT character. Depress key FIELD SEL again to identify the character as the last one to be included in the message's CRC/LRC calculation. Next, depress key DON'T CARE to initiate calculation of the CRC/LRC character. The full intensity delimiter is now positioned over the CRC/LRC character; the last character to be transmitted.

After the preceding steps are completed, move the cursor back to the message's first character. Depress key FIELD SEL to delimit the first character of the message that will be transmitted.

Remove the delimiter from the first data character that was included in the CRC/LRC calculation by placing the cursor over the delimiter, and then depressing key FIELD SEL.

3-6. SEGMENTING VARIABLE LENGTH MESSAGES

The buffer's 128-character unprotected field can be used for variable length messages that are sent sequentially each time DLM III transmits. Although impractical, the field's contents can be segmented into a maximum of 64 2-character messages. Note the prompt shown at the bottom of the screen:

"DELIMIT MESSAGE WITH FIELD SEL"

When entering data into an unprotected field, use the cursor control keys to position the cursor at any character location within the field. Enter character data into the field at the cursor position using the hexadecimal keypad.

Identify the individual messages using key FIELD SEL to delimit the first and last characters of each message. This is done by positioning the cursor over the first character in an individual message and depressing key FIELD SEL. The character under the cursor is shown full intensity afer key FIELD SEL is depressed. Next, position the cursor over the message's last character and depress FIELD SEL again. This second character is also shown full intensity and identifies the last character that will be transmitted in the message; see part 2 of Figure 3-8.

The procedure described can be used to delimit a maximum of 64 messages with the following results; the third and fourth full intensity characters identify the second message, the fifth and sixth the third message, etc.

Calculate CRC/LRC characters for individual messages using the procedure described in paragraph 3-5.

3-7. TRANSMITTING MESSAGES

DLM III transmits messages from the buffer when it is in the active (output) state and one of the four following events occur; a valid trap sequence is detected, a selected trigger signal is detected, a preset time delay has elapsed, or the keypad's DON'T CARE key is depressed. The first three events are treated as "or" conditions by DLM III because if more than one of the three is selected, the buffer's contents are transmitted when any one of the events occur. However, DLM III always transmits the buffer's contents when it is in the active state and the keypad's DON'T CARE key is depressed.

One of the buffer's delimited messages (up to 64) in the 128-character field is transmitted when any one of the four events occurs. Messages are each sent sequentially. For example, if the buffer's first delimited message is sent when a trigger signal is detected, then the second message is sent when the next event occurs.

The following paragraphs describe how each of the four conditions (events) are used.

3-7-1. TRAP

A delimited message is transmitted when the "trap" field contains one or more characters and the "search" field shows "send," "receive," or "both" (refer to paragraph 3-4-3; TRAP). A trap occurs when the trap field's contents are matched with data captured by DLM III. When a trap occurs, DLM III transmits the delimited message no later than 10 ms after matching the trap sequence with captured data.

3-7-2. TRIGGER

A delimited message is transmitted when a signal that is jumpered from DLM III's breakout panel to a TRIG (+) or (-) connector occurs, and the "eia ind" field shows "trig + & -"; refer to paragraph 3-4-3; EIA IND. For example, if field "eia ind" shows "trig + & -", and signal CTS is jumpered from the breakout panel to connector TRIG (+), then DLM III transmits no later than 10 ms after an occurence and positive transition of CTS.

3-7-3. TIME

A delimited message is transmitted according to the timing data entered in the output menu's "sec" field. This field must contain numeric data for the "time" option to initiate transmission of the buffer's next contiguous message. If no transmission is desired, enter video blanks into the field or clear the field. This is necessary because the "time" option is disabled only when field "sec" or "time" contains all video blanks. Numbers shown in this field define the delay between the time an event occurs and the buffer's next message is transmitted. Three selectable events cause messages to be sent; detection of a valid trap sequence, detection of a selected trigger signal, and depression of key DON'T CARE; refer to paragraph 3-7, TRANSMITTING MESSAGES.

The preset "time" option works in the following way; if 001.00 is entered in field "sec," then delimited messages are transmitted with a one second delay (intermessage time) between each contiguous message. DLM III's timing circuits reset to the value shown in field "sec" after each message transmitted regardless of what caused the message to be sent: trap, trig, or don't care.

DLM III's maximum intermessage time is 655 seconds, or 10.9 minutes.

3-7-4. DON'T CARE KEY

Depressing the keypad's DON'T CARE key causes the buffer's next contiguous message to be transmitted immediately, regardless of any output options used. Any time key DON'T CARE is depressed and DLM III is in the active (output) state, the buffer's next message is transmitted.

When transmission is being controlled using key DON'T CARE, the output menu's "sec" field may contain video spaces; this is accomplished by depressing the CLEAR key. However, the buffer's next message is transmitted when key DON'T CARE is depressed regardless of any timing data entered in field "sec."

3-8. PRINTER MENU

The printer menu appears on the screen when DLM III is halted and key HEX OUT is depressed. Figure 3-9 shows an example of the printer menu. Menu parameters selected by the operator must agree with the operating parameters of the printer connected to DLM III. Selections in this menu are made in the same manner as for the unit's main menu, and DLM III operates according to the menu's final state. Some printer may require that additional leads be brought high. This operation can be performed thorugh using the DLM III's breakout panel.

Prompts below the menu's variable fields tell the operator the keying sequence to follow when performing a print operation. During the actual printing operation, the word "printing" blinks until the operation is completed. While "printing" is shown blinking on the screen, all keys except HALT are disabled, and depressing HALT will stop the printing operation. All keys are again enabled after the buffer is empty, and the printer stops.

The HEX OUT connector's mechanical and electrical characteristics are described in paragraph 2-5-2, and Table 2-3.

The contents of the printer menu are:

SPEED.....Initial is 300 baud. Selections available are 50, 75, 110, 134.5, 150, 300, 600, 1050, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, and 19.2 kbps.

COLUMNS.....Initial is 80 columns. Selections available are 40, 64, 80, and 132 columns.

CR/LF.....Initial carriage return/line feed (CR/LF) delay is 200 ms. Selections available are DLY 0 MS, DLY 10 MS, DLY 50 MS, and DLY 200 MS.

PARITY.....Initial is NONE. Selections available are ODD, EVEN, ALL ONE, and ALL ZERO.

OUTPUT.....BUFFER

INFO.....Initial is DATA. Alternate is MENU.

Characters and data are sent to the printer in 7-bit ASCII code with parity as specified in the final menu's "parity" field. Stop marks are fixed at two per character. All data are converted to the appropriate ASCII hexadecimal code before being sent to the printer.

Carriage return and line feed characters ("cr/lf") are sent to the printer at count "XX" according to the "columns" field's contents.

If field "output" shows "buffer," data are sent to the printer starting with the character located under the cursor and ending with the character located at the end of the capture buffer. If less data than the remaining buffer contents are desired, depress the halt key and output will cease to the buffer.

Each printed line begins with either a letter "T" or "R." The "T" indicates that the line contains transmit data, and the "R" indicates that the line contains receive data. Each "T"-"R" data group is separated by a carriage return/line feed.

When the menu is printed (field "info" shows "menu"), protected variable field data are printed in the ASCII format, and unprotected variable field data are printed in hexadecimal code.

All print operations are started by depressing key RUN HALT when the printer menu is shown on the video display. Depressing key RUN HALT a second time stops print operations. To return DLM III to normal operations, depress key HEX OUT.

3-9. EXTERNAL VIDEO DISPLAY

Any external video display unit that uses a composite video input signal that is RS-170 compatible can be connected to DLM III. The external video display is identical to DLM III's display.

Connect the external video display unit to the connector labeled VIDEO located on DLM III's rear panel; see Figure 2-1. Use a coaxial cable terminated with a standard male BSC connector.

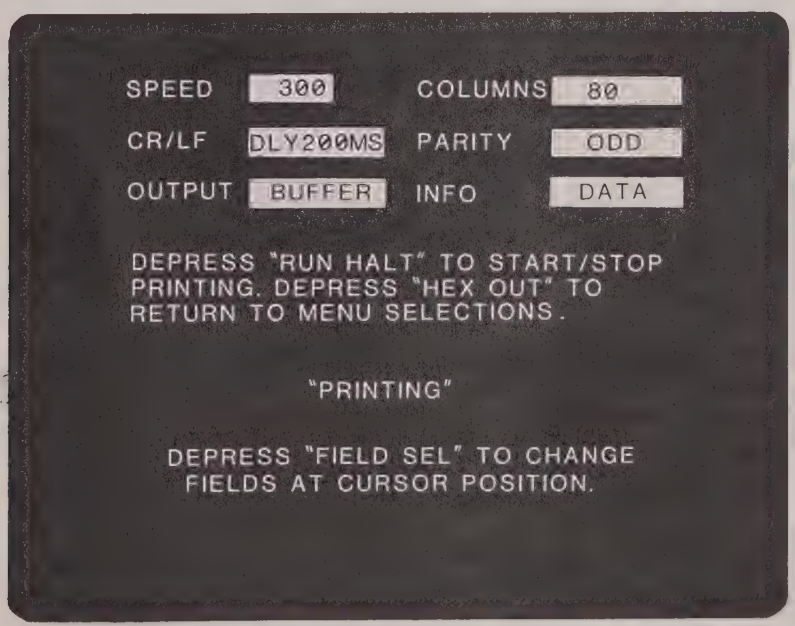


FIGURE 3-9. PRINTER MENU; REPRESENTATIVE ILLUSTRATION

3-10. EXTERNAL EVENT MARKER

Circuits in DLM III provide a +5 V, 5us, TTL-compatible output pulse when a parity or block check error is detected, when a trap occurs, and when key ERROR RESET is depressed. The marker pulse is available at connector ERROR OUT on DLM III's rear panel; see Figure 2-1. Use a coxial cable terminated with a standard male BSC connector to route the marker pulse to external test equipment.

3-11. MASS STORAGE INTERFACE

DLM III's rear panel connector labeled MSU III INTERFACE is provided for mass storage of line data for viewing at a later time; see Figure 2-1. This connector is pin-to-pin compatible with DIGILOG's MSU III mass storage unit. MSU III can store up to 409,600 bytes of data.

The MSU III INTERFACE connector's mechanical and electrical characteristics are described in paragraph 2-5-2, and Table 2-3.

DLM III can be used to view data after it is stored on diskettes by MSU III. Place DLM III in the halt mode, select MSU read mode by depressing key MSU READ (BUFF CLEAR on retrofitted units), and follow the directions contained in both this manual and the MSU III's Operator's Manual.

CHAPTER 4

SYSTEM TEST CONFIGURATIONS

4-1. INTRODUCTION

This chapter describes how to use DLM III for system test operations. Examples are given that show the operator how to set up DLM III at a remote site and perform test operations using the unit's passive and active states.

Before attempting to use DLM III for system testing, the operator should be familiar with the contents of Chapter 2, Description of Equipment; and Chapter 3, Operation.

4-2. REQUIRED INFORMATION AND EQUIPMENT

In order to save time, the DLM III operator should know the communication system's basic operating parameters; for example, the system's protocol structure, code, and transmitting speed. If these parameters are not known, the operator should either ask supervisory personnel, or look them up in the system's manuals.

An extra EIA RS-232-C standard interface cable is needed to connect DLM III into the system. System connection is made to DLM III's rear panel connectors labeled TO DTE (to data terminal equipment) and TO DCE (to data communication equipment); see Figure 2-1. Both connectors are type DB25S, 25-pin female.

Six jumper cords are supplied with DLM III. They are used at the test points on the unit's front panel to jumper signals between the DCE and DTE, from either the DCE or DTE to trigger inputs, and to jumper (+) and (-) 12 VDC from DLM III to either the DCE or DTE; see Figure 2-3.

4-3. SIGNAL AND POWER CONNECTIONS

Check the power and signal connections to the site's communications equipment. If a power connection is broken, either physically or because it is plugged into a switched receptacle, reconnect power to the equipment. If a signal connection is broken, or suspected of being faulty, repair the connector or connector leads.

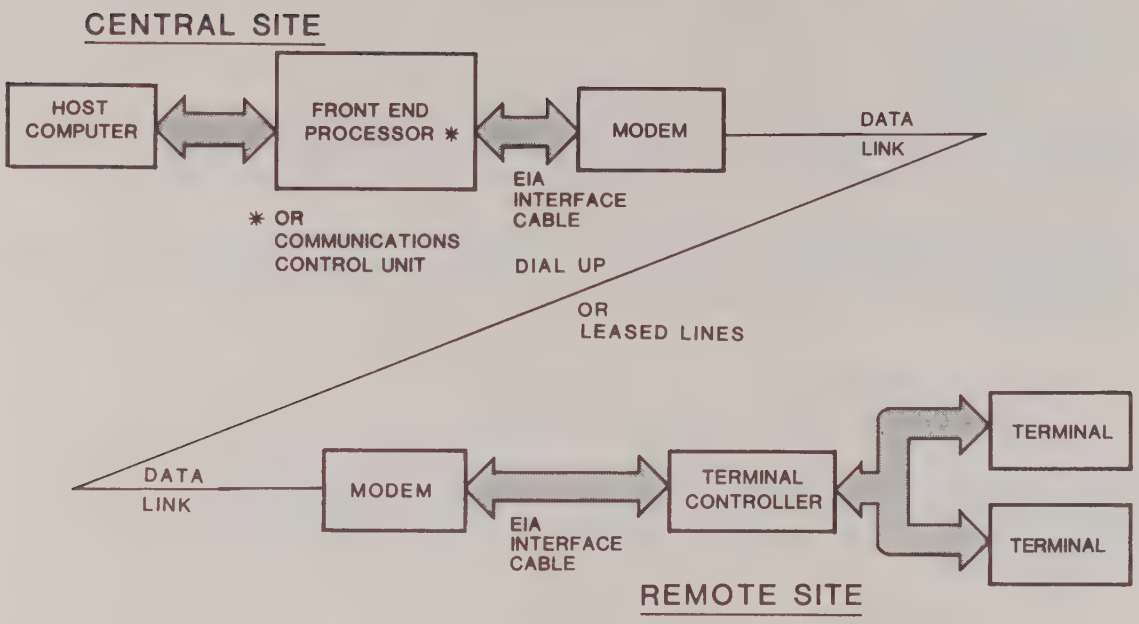


FIGURE 4-1. A COMMUNICATION SYSTEM;
FUNCTIONAL BLOCK DIAGRAM

4-3-1. EQUIPMENT STATUS INDICATORS

Check the terminal controller's status indicators if there are any present. In many cases, the status indication displayed will be listed in the equipment's maintenance manual, and the operator can identify the fault without taking the equipment off-line.

4-3-2. EQUIPMENT OFF-LINE TEST

Check equipment that is suspect off-line, if this is possible, to prevent interrupting system operation. For example, if a terminal is found to be faulty after a first inspection of the site's equipment, the terminal should be taken off-line, repaired, and its operation verified before it is placed back on-line.

4-4. DLM III SYSTEM INTERFACE CONNECTIONS

The following paragraphs describe how to connect DLM III into a typical multipoint, synchronous communication system; see Figure 4-1. The host computer uses the front end processor (FEP) to access the communications network. Nearly all of the network's operations are controlled by the FEP.

The FEP sends and receives serial data to the remote site over a data link that is usually supplied by the telephone company. Modems are used to change the serial digital data to an analog signal that can be transmitted over the data link.

The FEP also controls the exchange of messages in a system by using one of the data link protocols, such as SDLC. These protocols enable the FEP to interact with terminals at the remote site through the terminal controller (TC).

At the remote site, the TC controls the exchange of messages between the data link and the site's terminals. The TC usually operates under control of the FEP. The following paragraphs contain additional information about the remote site's TC and modem, because DLM III is connected into the system between them; see Figure 4-2.

4-4-1. EIA INTERFACE CONNECTIONS

Use the following procedure to connect DLM III:

> *NOTE*
>
> CHECK THE EIA INTERFACE CABLE AND CONNECTOR FOR BROKEN WIRES AND CONNECTIONS. CLEAN THE CONNECTOR, IF NECESSARY, WHILE IT IS DISCONNECTED.

1. Request permission to connect DLM III into the system. Ask for any information that may be needed to set up DLM III for testing, such as the TC's address.

2. Inform the remote site's supervisor that service will be interrupted for system testing. DO NOT break any connections until permission is granted.

3. Plug in DLM III's line cord and set the unit's POWER switch to ON. Verify that DLM III passes its initial self-test and then depress key MENU SEL. Menu page 1 is seen on the screen.

4. Disconnect the EIA interface cable from the TC, and connect the cable to the TO DCE connector on DLM III's rear panel.

5. Connect the spare interface cable between the TC's modem connector and DLM III's TO DTE connector.

The communication system is now back in operation. DLM III provides a transparent interface between the modem and TC, and the operator can begin monitoring data using DLM III's passive operating state.

REMOTE SITE

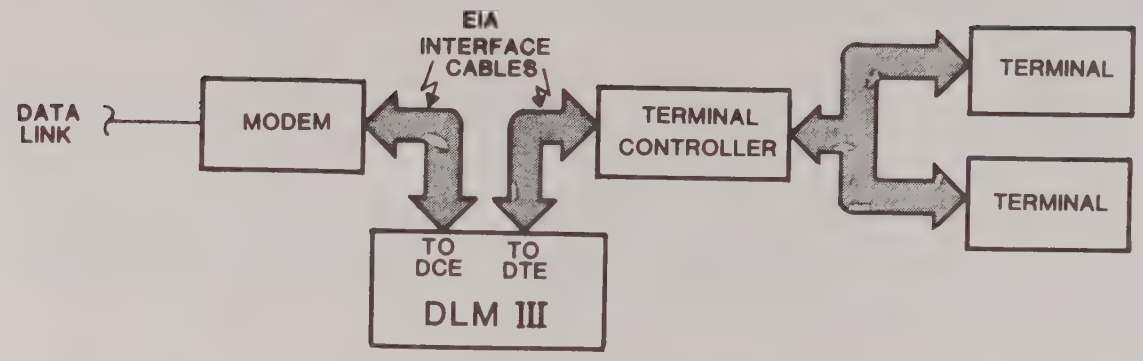


FIGURE 4-2. DLM III INTERFACE CONNECTIONS; FUNCTIONAL BLOCK DIAGRAM

4-4-2. INITIAL ON-LINE CHECK OUT

Specific EIA interface handshaking signals must be present when messages are sent or received at the remote site in a synchronous communications system. The DLM III operator must verify that these signals are active as soon as DLM III is connected at the interface. This can be done by observing the LEDs. In most cases, the signals listed in Table 4-1 are always necessary; however, the operator should check each system's requirements to ensure that the proper combination of EIA handshaking signals are active.

Twelve light-emitting diode (LED) indicators on DLM III's breakout panel light when the interface signal it monitors is true (active). Each LED has its signal's name marked on the panel, just below the indicator.

Table 4-2 lists the handshaking signals, their interface connector pin number, and both their RS-232-C and CCITT V.24 designations.

The DLM III operator should keep the following three things in mind while checking out system functions at the remote site:

1. Synchronous interface signals DSR, SCT, SCR, and DTR must be true even when no data is being sent or received. Asynchronous signals only require DSR and DTR to be present.

2. When the central site is polling the remote site, signals DSR, SCT, SCR, DTR, CD, and RD must be present. For asynchronous systems, SCT and SCR need not be present.

3. When the remote site responds to the poll signals DSR, SCR, DTR, RTS, CTS, and SD must be present. Asynchronous systems do not use SCR.

(End)

TABLE 4-1. REQUIRED EIA INTERFACE SIGNALS;
STANDARD SYNCHRONOUS MULTIPOINT COMMUNICATION SYSTEM

SIGNAL	PIN	FUNCTION
MUST ALWAYS BE PRESENT TO SEND AND RECEIVE MESSAGES		
DSR	6	Data set ready
SCT	15	Transmit clock
SCR	17	Receive clock
DTR	20	Data terminal ready
MUST BE PRESENT TO RECEIVE MESSAGES		
SCR	17	Serial clk. receive
CD	8	Carrier detect
RD	3	Received data
MUST BE PRESENT TO SEND MESSAGES		
SCT	15	Serial clk. transmit
RTS	4	Request to send
CTS	5	Clear to send
SD	2	Send data

4-4-3. MONITORING DATA EXCHANGE BETWEEN SITES

After the EIA interface handshaking signals are checked out, the operator should set up DLM III for monitoring the exchange of messages at the interface. Setting up DLM III requires the operator to enter into the menu fields system operating parameter information. Normally only the fields shown in the menu's first page need changing. Use the following procedure to set up DLM III:

1. Depress key MENU SEL, and note the baud rate displayed in field "speed." Depress key FIELD SEL until the correct speed is displayed. If an external clock is supplied, select "external." If none of the numbers seen is correct for the system, select "other" and use the keypad's decimal keys to enter the needed baud rate into the field (multiples of 1 may be entered, and the minimum number is 28).

2. Move the cursor to field "bits." Depress key FIELD SEL until a number shows in the field that equals the number of bits per character used in the system, <u>including parity</u>. If the number of bits isn't known, select "stream"; refer to paragraph 3-4-2.

3. Move the cursor to the "code" field, and depress key FIELD SEL until the name of the system's code appears.

(Continued)

TABLE 4-2. EIA INTERFACE CONNECTOR PIN DESIGNATIONS

PIN NO.	RS-232-C (DLM III) DESIGNATION	CCITT V.24 DESIGNATION	FUNCTIONAL DESCRIPTION
1	AA	101	Frame ground.
2	BA (SD)	103	Transmitted data to data link.
3	BB (RD)	104	Received data from data link.
4	CA (RTS)	105	Request to send; signal from terminal to modem.
5	CB (CTS)	106	Clear to send; signal from modem to terminal.
6	CC (DSR)	107	Data set ready; signal from modem to terminal.
7	AB	102	Signal ground; common ground between modem and terminal.
8	CF (CD)	109	Data carrier detect; signal from modem to terminal
9	**	***	USED FOR TESTING. DLM III USES PIN 9 TO SUPPLY +12 VDC.
10	**	***	USED FOR TESTING. DLM III USES PIN 10 TO SUPPLY -12 VDC.
11	**	***	Not assigned.
12	SCF	122	Secondary data carrier detect; signal from modem to terminal.
13	SCB	121	Secondary clear to send; sent from modem to terminal.
14	SBA	118	Secondary transmitted data to data link.
15	DB (SCT)	114	Transmit clock timing; signal transmit clock timing.

(Continued)

TABLE 4-2. EIA INTERFACE CONNECTOR PIN DESIGNATIONS
(Continued)

PIN NO.	RS-232-C (DLM III) DESIGNATION	CCITT V.24 DESIGNATION	FUNCTIONAL DESCRIPTION
16	SBB	119	Secondary received data from data link.
17	DD (SCR)	115	Send clock receive; from modem to terminal.
18	**	***	Not assigned.
19	SCA	120	Secondary request to send; sent from terminal to modem.
20	CD (DTR)	108	Data terminal ready; sent from modem to terminal.
21	CG (SQ)	110	Signal quality indicator; sent from modem to terminal.
22	CE (RI)	125	Ring indicator; signal from modem to terminal.
23	CH/CI	111/112	Transmit rate selector; sent from terminal to modem.
24	DA	113	External timing;
25	**	***	Not assigned.

(End)

4. Move the cursor to the "sync" field. Use the hexadecimal keys to enter the system's sync character(s), if any.

5. Depress key RUN HALT to place DLM III in its run state.

6. Ask the central site to poll the faulty terminal equipment. As soon as character data appear on the video display, check the status of LED indicators CD, RD, RTS, CTS, and SD. If any of these indicators are not lit the poll can not be responded to; refer to Table 4-1.

(Continued)

7. Check the displayed data. Data received over the data link are underlined, and data sent to the data link are not. Blinking characters indicate incorrect parity, and half intensity characters indicate that these characters are not in syncronization.

8. Depress RUN HALT to halt DLM III at any time. Data not seen on the video display may be stored in the capture buffer. Press the cursor control up or down key to see the capture buffer's contents; refer to paragraph 2-4-2-9.

4-4-4. EVALUATING RESULTS OF DATA EXCHANGE BETWEEN SITES

Once DLM III is connected into the system and a poll is requested from the central site, the operator must follow a step-by-step procedure in order to identify and locate the fault. The purpose of the procedure is to verify in a logical sequence the operation of components in the system, starting with the EIA interface and ending with a terminal. A proposed procedure is outlined in the following paragraphs, and is included as a guide.

1. Observe the status of the EIA interface signals listed in both Tables 4-1 and 4-2 using DLM III's indicators. If a signal is absent, check the equipment and cables supplying the signal.

2. Observe the received data shown on DLM III's video display for error indications; such as blinking and half intensity characters. Check the front panel's error indicators. Check that the data addressing and characters are correct.

3. Observe the response from the terminal controller (TC) to a successfully received poll. Note especially the EIA signals, and the characters sent from the TC.

If a valid poll is received from the central site, and if the correct EIA signals are sent from the TC to DLM III indicating that the TC received the poll, then the operator will have to go off-line and check the data link between the TC and addressed terminal. Operators having DLM III's with output capability should refer to paragraph 4-4-5.

If a valid poll is received from the central site and the correct EIA signals are sent from the modem to DLM III, then the operator may assume that equipment ahead of the FEP is functioning properly.

However, if no signal is received either the carrier lines or modem may be faulty. The modem is probably at fault if other equipment at the remote site is operational and connected to the same carrier lines. A bit error rate test (BERT) should be performed at this time; refer to parapraph 4-4-5.

Received data having an error rate exceeding 20 errors in 20 minutes (average) means that either the modem or carrier lines are faulty. If possible, put a known good modem in the system and resume monitoring. A continued high error rate indicates that the carrier lines should be checked. If this occurs, call the carrier's local office, explain the problem and ask for a level check on the line.

A poll that is correctly received at the remote site and results in the proper response indicates that the remote site's equipment, except for the modem, is probably operational. If the message is acknowledged at the central site, then the operator can assume either that no problem exists, or that the problem was repaired.

At this point the operator should remove DLM III from the system, return all cables to their original connectors, and then request a poll from the central site. If the problem returns, the fault may be that the cabling or associated connectors have an intermittent open or shorted connection.

4-4-5. TROUBLESHOOTING USING DLM III'S BIT ERROR-RATE TEST (BERT) CIRCUITS

DLM III's bit error-rate test circuits can be used to verify that both the central and remote sites' modems and the data link are operational. If a fault exists in these components, then the BERT can be used to isolate the fault to either a particular modem or one of the data link's transmission lines.

4-4-5-1. General Information

As shown in Figure 4-3, two DLM III's are required to perform a complete end-to-end test of the communication system. Note that the data terminal equipment (DTE) at both the central and remote sites are not involved in this test.

End-to-end testing of the communications system uses the BERT circuits contained in both DLM IIIs. The BERT generator in each unit develops a test pattern that is sent by the modem (DCE) over the data link. The BERT comparators then test the received pattern, and, if any errors are detected, update the "BIT ERROR" and/or "BLOCK ERROR" status messages shown on the video display. At the same time, the display shows in half intensity character(s) that are out of syncronization; refer to MODE of paragraph 3-4-4 and see Figure 3-8.

If the comparators detect no errors, the only change seen on the unit's video display is the change in the status message's "RUN TIME" (elapsed time of test) indicator.

Because the end-to-end test checks each side of the line independent of the other, this test provides three indications:

1. Both sides of the line are operational.

2. Both sides of the line are faulty.

3. A particular side of the line is faulty.

If an excessive error rate (greater than 20 errors in 20 minutes, average) occurs at either DLM III, analog loopback tests performed at both sites can be used to verify each modem's status.

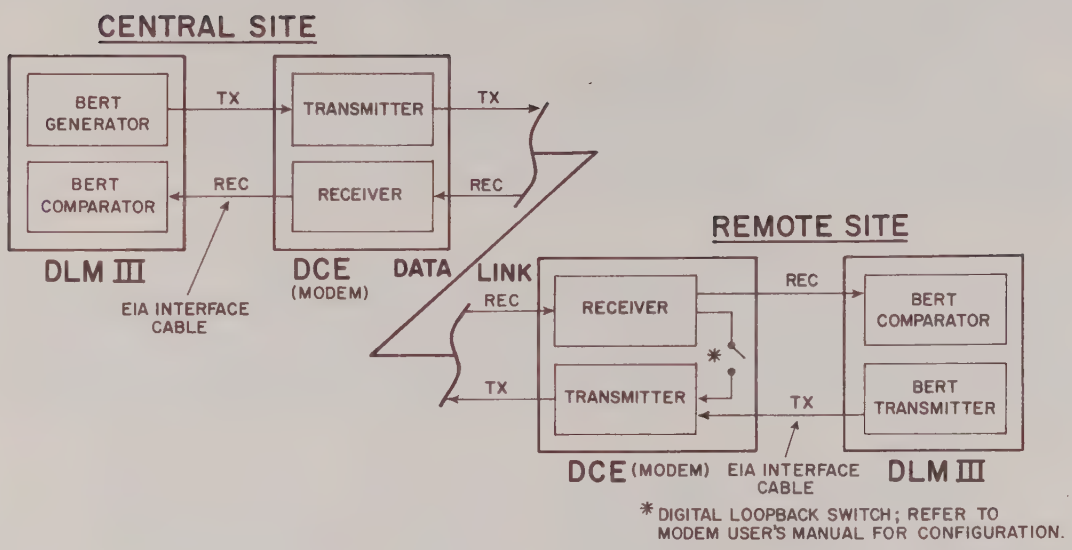


FIGURE 4-3. BERT TEST SETUP; FUNCTIONAL BLOCK DIAGRAM

A variation of the end-to-end test is to use one DLM III and to place the receiving site's modem in the digital loopback configuration; see REMOTE SITE of Figure 4-3. This test can be performed using DLM III at either the central or remote sites, and can be used along with the analog loopback tests to verify the communication system's status.

4-4-5-2. BERT Operation

Establish voice communication between the sending and receiving sites, and set up both DLM IIIs for BERT operation using the following general procedure:

1. Using a standard EIA interface cable, connect the modem to the DLM III at the DLM III's rear panel DCE connector.

2. Call page 1 of both DLM III's menu and set up both DLM IIIs to operate at the same speed. Insure that the speed selected is compatible with the two modems' operating parameters.

3. Call menu page 3, and set up both DLM IIIs to ACT AS DTE (data terminal equipment) and to operate in MODE BERT 511.

(Continued)

4. Check that both DLM IIIs are providing the proper EIA signals to the modems; for example, RTS, CTS, DSR, and CD.

5. Start BERT by depressing key RUN HALT. Note that the test characters and status message are shown on the DLM IIIs' screen.

6. Depress key DON'T CARE to inject errors into the test pattern transmitted. This is done to ensure that both DLM IIIs' BERT circuits are operational. Up to seven bit errors and a block error can be recorded each time key DON'T CARE is depressed.

7. Stop BERT by again depressing key RUN HALT.

8. Return to normal, or passive, operation by depressing key MENU SEL and going to menu page 1.

(End)

APPENDIX 1

CODE CHARTS

ASCII CODE CHART DIGILOG P/N 20-1150-01

b7 b6 b5					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
1st HEX*b8=0					0	1	2	3	4	5	6	7
Digit*b8=1					8	9	A	B	C	D	E	F
2nd HEX DIGIT												
b4	b3	b2	b1									
0	0	0	0	0	NU	DL		0	@	P	\	p
0	0	0	1	1	SH	D1	!	1	A	Q	a	q
0	0	1	0	2	SX	D2	"	2	B	R	b	r
0	0	1	1	3	EX	D3	#	3	C	S	c	s
0	1	0	0	4	ET	D4	$	4	D	T	d	t
0	1	0	1	5	EQ	NK	%	5	E	U	e	u
0	1	1	0	6	AK	SY	&	6	F	V	f	v
0	1	1	1	7	BL	EB	'	7	G	W	g	w
1	0	0	0	8	BS	CN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	A	LF	SB	*	:	J	Z	j	z
1	0	1	1	B	VT	EC	+	;	K	[	k	{
1	1	0	0	C	FF	FS	,	<	L	\	l	¦
1	1	0	1	D	CR	GS	-	=	M	]	m	}
1	1	1	0	E	SO	RS	.	>	N	↑	n	~
1	1	1	1	F	SI	US	/	?	O	←	o	DT

*Dependant on Parity

CONTROL CHARACTERS

NU	NUII Character
SH	Start of Header
SX	Start of Text
EX	End of Text
ET	End of Transmission
EQ	Enquiry
AK	Acknowledge
BL	Bell
BS	Backspace
HT	Horizontal Tab
LF	Line Feed
VT	Vertical Tab
FF	Form Feed
CR	Carraige Return
SO	Shift Out
SI	Shift In
DL	Data Link Escape
D1	Device Control 1
D2	Device Control 2
D3	Device Control 3
D4	Device Control 4
NK	Negative Acknowledge
SY	Synchronous Idle
EB	End Transmission Block
CN	Cancel
EM	End of Medium
SB	Substitute
EC	Escape
FS	File Separator
GS	Group Separator
RS	Record Separator
US	Unit Separator
DT	Delete

JFM 5-18-81

EBCDIC CODE CHART DIGILOG P/N 20-1150-01

b8 b7 b6 b5		0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1	1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
1st HEX DIGIT		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2nd HEX DIGIT																	
b4 b3 b2 b1																	
0 0 0 0	0	NU	DL	DS	30	40	&	-	70	80	90	A0	B0	C0	D0	E0	0
0 0 0 1	1	SH	D1	SS	31	41	51	/	71	a	j	A1	B1	A	J	E1	1
0 0 1 0	2	SX	D2	FS	SY	42	52	62	72	b	k	s	B2	B	K	S	2
0 0 1 1	3	EX	D3	23	33	43	53	63	73	c	l	t	B3	C	L	T	3
0 1 0 0	4	PF	RE	BP	PN	44	54	64	74	d	m	u	B4	D	M	U	4
0 1 0 1	5	HT	NL	LF	RS	45	55	65	75	e	n	v	B5	E	N	V	5
0 1 1 0	6	LC	BS	EB	UC	46	56	66	76	f	o	w	B6	F	O	W	6
0 1 1 1	7	DT	IL	EC	ET	47	57	67	77	g	p	x	B7	G	P	X	7
1 0 0 0	8	08	CN	28	38	48	58	68	78	h	q	y	B8	H	Q	Y	8
1 0 0 1	9	09	EM	29	39	49	59	69	79	i	r	z	B9	I	R	Z	9
1 0 1 0	A	MM	CC	SM	3A	¢	!	70	:	8A	9A	AA	BA	CA	DA	EA	FA
1 0 1 1	B	VT	1B	2B	3B	.	$	,	#	8B	9B	AB	BB	CB	DB	EB	FB
1 1 0 0	C	FF	1F	2C	D4	<	*	%	@	8C	9C	AC	BC	CC	DC	EC	FC
1 1 0 1	D	CR	IG	EQ	NK	(	)	_	'	8D	9D	AD	BD	CD	DD	ED	FD
1 1 1 0	E	SO	IR	AK	3E	+	;	>	=	8E	9E	AE	BE	CE	DE	EE	FE
1 1 1 1	F	SI	US	BL	SB	I	¬	?	"	8F	9F	AF	BF	CF	DF	EF	FF

CONTROL CHARACTERS

NU NUll Character
SH Start of Header
SX Start of Text
EX End of Text
PF Punch Off
HT Horizontal Tab
LC Lower Case
DT Delete
MM Start Manual Message
VT Vertical Tab
FF Form Feed
CR Carraige Return
SO Shift Out
SI Shift In
DL Data Link Escape
D1 Device Control 1
D2 Device Control 2
D3 Device Control 3
RE Restore
NL New Line
BS Back Space
IL Idle
CN Cancel
EM End of Medium
CC Cursor Control
IF Info. Field Sep.
IG Info. Group Sep.
IR Info. Record Sep.
US Info. Unit Sep.
DS Digit Select
SS Start of Significance
FS Field Separator
BP By Pass
LF Line Feed
EB End Transmission Block
EC Escape
SM Set Made
EQ Enquire
AK Acknowledge
BL Bell
SY Synchronous Idle
PN Punch On
RS Reader Stop
UC Upper Case
ET End of Transmission
D4 Device Control 4
NA Negative Acknowledge
SB Substitute

JFM 5/18/81

Should the DLM III malfunction, it is advisable to contact DIGILOG's Customer Service Department at (215) 628-4530. Before calling, have the model, serial and configuration numbers on hand along with the unit's parameter setup at down-time and the failure symptoms. If necessary, the card shown on this page can be used as a guideline for the information needed in the sevice call.

If the DLM III needs to be shipped to DIGILOG for repair, please use the cutout Customer Service Card below. Write in all information requested on the card, tape it to the top of the unit and ship the unit to:

DIGILOG, INC.
Customer Service Dept.
1370 Welsh Road
Montgomeryville, PA 18936

DLM III OPERATOR'S MANUAL
CUSTOMER SERVICE CARD

CUSTOMER SERVICE CARD

Company _____

Customer Contact _____

Street _____

City _____ State _____ Zip Code _____

Telephone (___) _____ Ext. _____

Model _____ Serial # _____ Config. # _____

- -

Parameters Set at Failure Time: Active _____ Passive _____

Protocol _____ Speed _____ Code _____ Timing _____

Invert Data _____

Parity _____ Framing _____ Out Sync _____ CRC/LRC _____

Failure Symptoms _____

_____

_____

DLM III
OPERATOR'S INSTRUCTION MANUAL

www.manualsplus.com
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DIGILOG
NETWORK CONTROL DIVISION
1370 Welsh Road
Montgomeryville, PA 18936
(215) 628-4530 TWX 510-665-6589